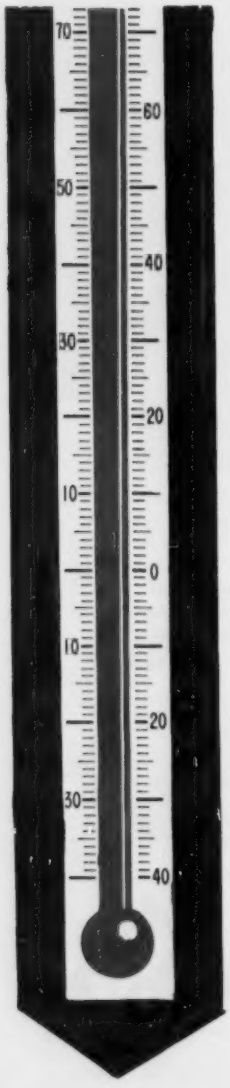
APRIL 19, 1954

Electrical World

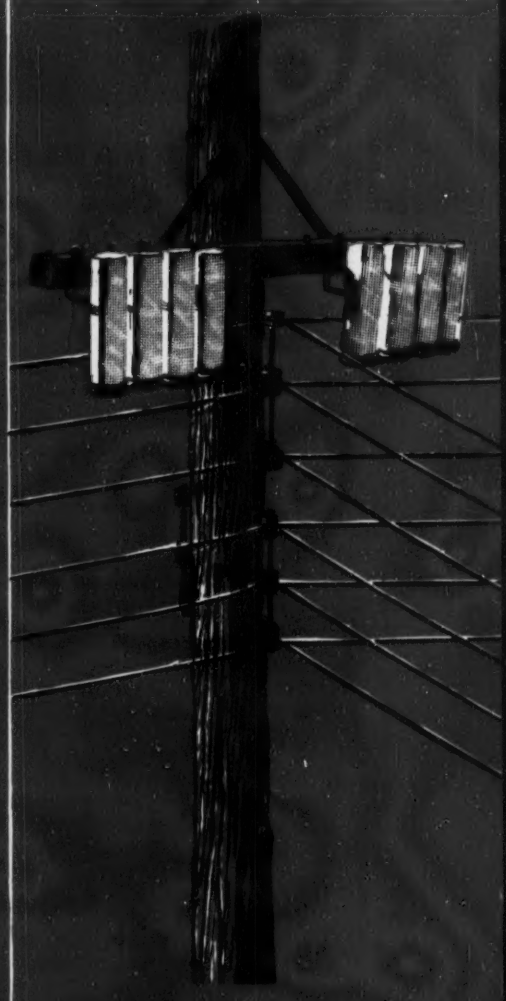
Price 35 Cents

A McGRAW-HILL PUBLICATION

When the temperature soars . . .



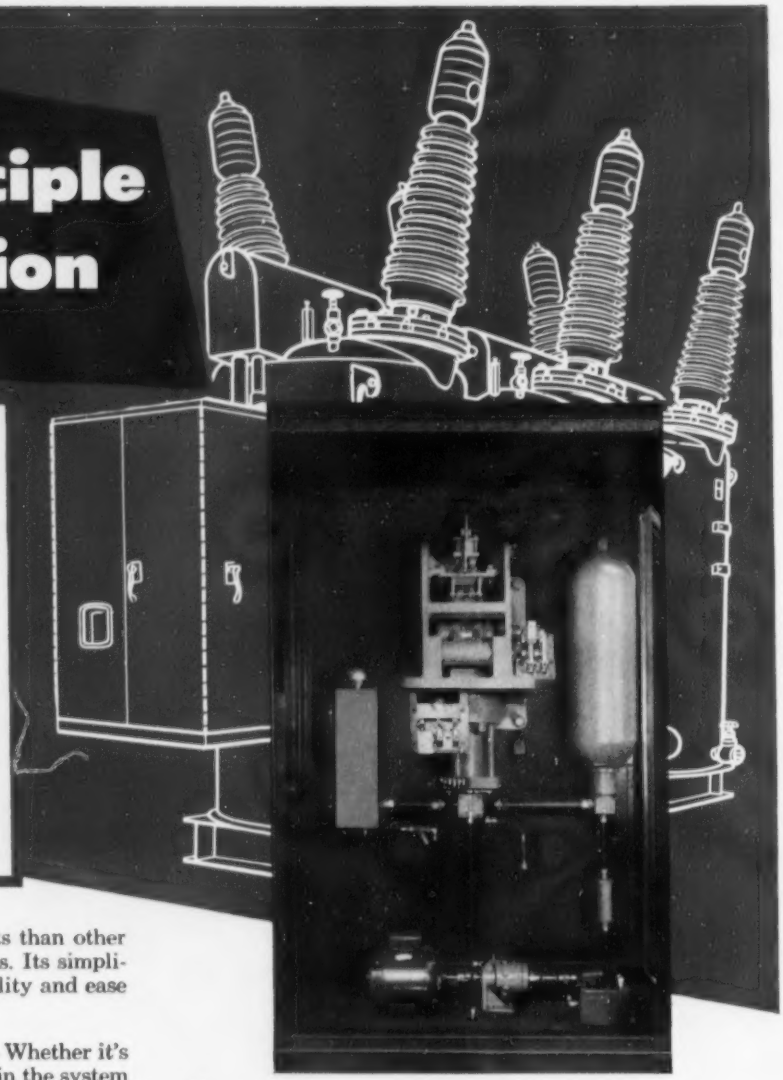
. . . appliance motor loads soar too . . .



. . . then secondary capacitors mean savings for Public Service Co of Oklahoma

See Page 110

New principle of operation



PNEU-DRAULIC Breaker Operator offers 7 advantages

By using the hydraulic principle of energy transmission — new to the breaker industry — Allis-Chalmers is able to offer an operating mechanism with outstanding advantages.

1 Simple — Has fewer parts than other types of operating mechanisms. Its simplicity is a measure of its reliability and ease of maintenance.

2 Unaffected by Weather — Whether it's hot or cold, the energy stored in the system provides more than the standard number of operations. Use of oil with constant viscosity over wide range of temperatures insures uniform performance.

3 No Moisture Problem — Entire system is filled with oil with inhibitor which eliminates rust and corrosion.

4 No Dirt Problem — In effect, it is a sealed system with efficient filtering to eliminate the hazard of dust and dirt.

5 Fast — In fact, it actually could be set to operate at speeds far faster than present useful speeds.

6 Emergency Closing — It can be closed at full speed onto an energized line even when no control power is available.

7 Mechanically trip-free — The simple mechanically trip-free mechanism, proven on other Allis-Chalmers high speed breakers, has been adapted to the *Pneu-Draulic* operator. A-4285

The *Pneu-Draulic* operator is now available on breakers 69 kv and above. Watch for it on other ratings.

It will be to your advantage to investigate further the *Pneu-Draulic* operator and other features of these breakers. Call your nearby A-C district office for additional information, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

Pneu-Draulic is an Allis-Chalmers trademark.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

This Week's Authors

R. A. BOWMAN C. C. WHELCHEL

Use of new engineering trends that result in low operating costs for the Pittsburg Steam Plant of Pacific Gas & Electric Co is explained in an article on page 116. Co-authors of the article are R. A. Bowman, manager of engineering of Bechtel Corp's Power Division, and C. C. Whelchel, chief of PG&E's Division of Steam Engineering.

Active in Atomic Work . . . After graduating from the University of Arkansas in 1929, Bowman joined Westinghouse Electric Corp's Steam Division. When he became manager of engineering of Westinghouse's Atomic Power Division in 1948, Bowman engaged in the design of the nuclear power plant for submarines. He went to Bechtel in 1951.

For the past six and one-half years Whelchel has been active in Pacific G&E's postwar building program. Whelchel, who directed the utility's nuclear power feasibility study, now works on PG&E's nuclear power investigations.

Calvin H. Huber, who describes on page 114 how Commonwealth Edison Co's new trouble call procedure speeds service restoration during storms, holds a B.S. degree in electrical engineering from Illinois Institute of Technology. Huber was recently transferred from the utility's overhead construction department to the industrial relations department, where he is an advisor in education and training.

CALVIN H. HUBER

Electrical World

Published for 80 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Vol. 141 No. 16 CONTENTS April 19, 1954

Features

Nuclear Generation to Reach 200,000,000 Kw by 2000 AD 108
A. E. Knowlton

Secondary Capacitors Show Savings ..... R. H. Bishop 110

Lead Resistance Errors in Watthour Meter Tests 113
F. L. Hermach and T. L. Zapf

Streamlined Trouble Call Procedure Speeds Service Restoration 114
C. H. Huber

Pittsburg Plant—Low First Cost Plus High Efficiency 116
R. A. Bowman and C. C. Whelchel

Maintaining 21,000 Towers Poses Painting Problems ..... L. K. Yerger 120

Voltage Regulation for an Economic Rural System ..... R. W. Schlie 122

Departments

Editorials	99	Industrial Applications	156
The Electrical Week	101	Sales and Service	166
General News	102	New Equipment	186
Public Relations	126	Catalogs and Bulletins	198
Washington Comment	127	Letters	204
Technical Notes	127	News About People	206
Statistics	128	Manufacturers & Markets	216
Financial News	129	Meetings	219
How To	134	Books	220
Engineering Reference Sheet	144	Technical Literature	224

Index of Advertisers 229

RALPH H FLYNN, Publisher FISCHER BLACK, Editor DANIEL T BRAYMER, Managing Editor

A E KNOWLTON ..... Senior Associate Editor
FRANK R INNES ..... Associate Editor
LEONARD M OLMSTED ..... Associate Editor
ROBERT C BLATT ..... Associate Editor
KENNETH K KOST ..... Associate Editor
HERBERT R FRANKEL ..... Associate Editor
JOHN F WICKLEIN ..... Associate Editor
EDWARD ALLEN ..... Midwestern Editor
HOWARD S KNOWLTON ..... New England Editor
DEXTER M KEEZER ..... Dir Economics Department
RUE M SHOOP ..... Middle Eastern Editor
FRANCIS KOVALCIK ..... Western Editor
DAVID REA ..... Assistant Editor
JEANNE BERNHARDT ..... News Editor
IRIS ST CLAIR ..... Departmental Editor
ARY MOSSIMAN ..... Manager of Market Research
W J WALLACE, JR ..... Assistant Art Director
G B BRYANT ..... Mgr Washington Bureau
JESSE MOCK ..... Washington Correspondent
ROBERT P ULIN, RICHARD W EVERETT—Economics Department

WORLD NEWS BUREAU: Joseph K Van Denburg, Jr, Editor; London, Paris, Bonn, Tokyo, Sao Paulo, Mexico City, Manila. DOMESTIC NEWS SERVICE: Atlanta, Chicago, Cleveland, Detroit, San Francisco. Correspondents in 43 cities.

ADVERTISING STAFF: District Managers, E F Coffey, New York; N V Palmer, Boston; F P Coyle, Philadelphia; M S Kearney, Cleveland; E S Chapin, Detroit; W H Meneilley, Chicago; J T Schaefer, St. Louis; Robert H Sidur, Atlanta; Carl W. Dysinger, Los Angeles; John W Otterson, San Francisco; James Cash, Dallas

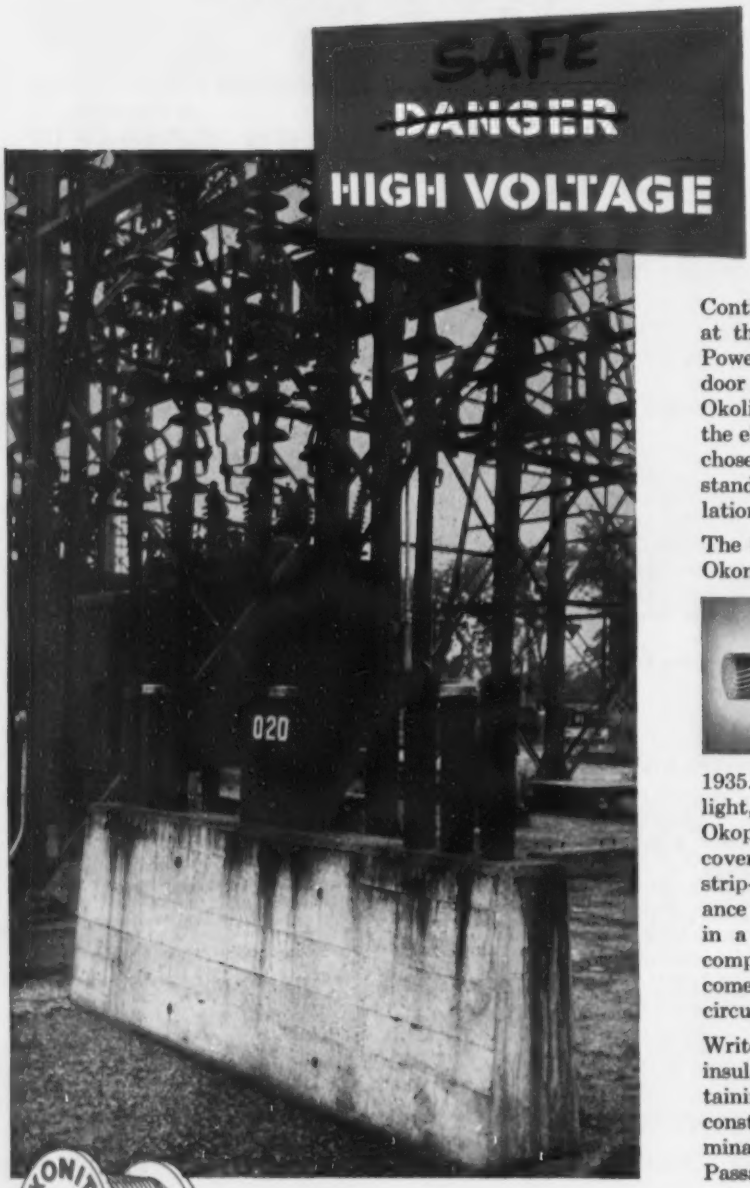
Published weekly by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder. **Publication Office, 99-129 North Broadway, Albany 1, N. Y. Executive, Editorial and Advertising Office: McGraw-Hill Building, 330 W. 42nd St., New York 36, N. Y.** Donald C. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerard, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation.

Subscriptions: Address correspondence to Electrical World—Subscription Service, 99-129 N. Broadway, Albany 1, N. Y., or 330 W. 42nd St., New York 36, N. Y. Allow one month for change of address.

Subscriptions are accepted from executives, supervisory and engineering personnel in electric utilities, manufacturing companies, and related fields. Position and company connection must be indicated on subscription orders.

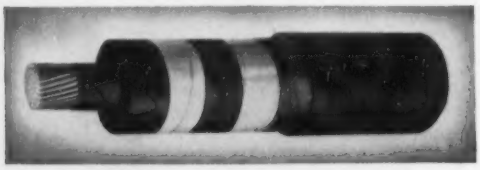
Single copies 35¢. For the United States and Possessions $6 a year, $9 for two years, $12 for three years. Canada, $7 for one year, $11 for two years, $14 for three years. (Canadian money, at par.) Other Western Hemisphere, $15 for one year, $25 for two years, $30 for three years. All other countries $25 for one year, $40 for two years, $50 for three years. Entered as second-class matter, November 16, 1936, at the Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in USA. Copyright 1954 by McGraw-Hill Publishing Company, Inc. Permission required to reproduce any of contents.

WEATHER EXTREMES ARE NO PROBLEM FOR OKOLITE-OKOPRENE POWER CABLES



Continuous exposure to severe weather extremes at the Mason Station of the Central Maine Power Company made specifications for outdoor high-voltage feeders extremely critical. Okolite-Okoprene, unaffected by exposure to the elements and having no oil to migrate, was chosen for the 15-kv feeders because of its outstanding record in utility and industrial installations.

The Okoprene sheath compound, an exclusive Okonite neoprene formula, has been in use since



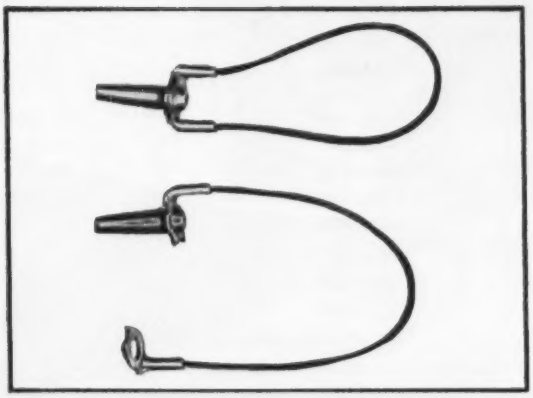
1935. High resistance to chemicals, acids, sunlight, moisture and most oils has established Okoprene as an extremely durable protective covering. Okolite insulation, applied by the strip-insulating process, is famous for its resistance to ozone, heat and moisture. Vulcanization in a continuous metal mold stabilizes these components into a durable cable that has become the industry standard for high-voltage circuits up to 35,000 volts.

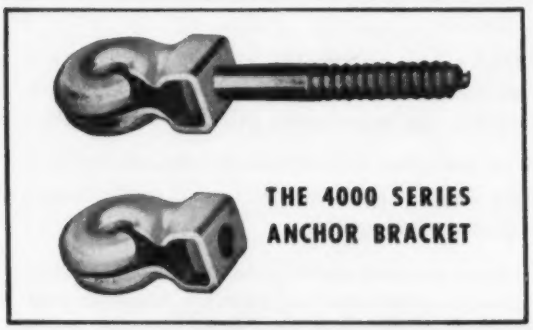
Write for your copy of the high-voltage, rubber-insulated cable manual, Bulletin EW-1075, containing 128 pages of detailed information on construction, installation, and splicing and terminating techniques. The Okonite Company, Passaic, N. J.

OKONITE SINCE 1878 *insulated cables*

2203

Electroline
AUTOMATIC DEAD-END
for Neutral Supported Multiple Conductor Service-Drop Cable





THE 4000 SERIES ANCHOR BRACKET

This Electroline Automatic Dead-End is designed for use with neutral-supported type of service drop. The insulation on the phase wires is not destroyed because these Dead-Ends grip only the bare neutral. This eliminates the possibility of shorting any phase. Available only for No. 6-AWG conductor. For automatic line Dead-Ends use the Electroline 3400 Series.

THE ELECTROLINE 3800 SERIES Automatic Dead-Ends lower construction costs because they are easily installed in a few seconds. This Dead-End is assembled as a one-piece unit with no loose parts to be dropped or lost. One end of the flexible bail is detachable for use with a spool-type insulator or other types of supporting anchorages now in service. This feature permits quick and easy installation with only one part, other than the conductor, to be handled by the lineman.

ELECTROLINE 4000 ANCHOR BRACKET — The 4000 Series Service Bracket, for use on permanently multi-grounded neutral systems (ideal for use with 3800 Series Dead-Ends as illustrated below), permits quick and simple insertion of a closed bail or loop—supports the cable at any angle. Installation costs are further reduced since this method of anchoring eliminates the insulator and insulator hardware.

WRITE FOR NEW BULLETINS FOR FULL INFORMATION

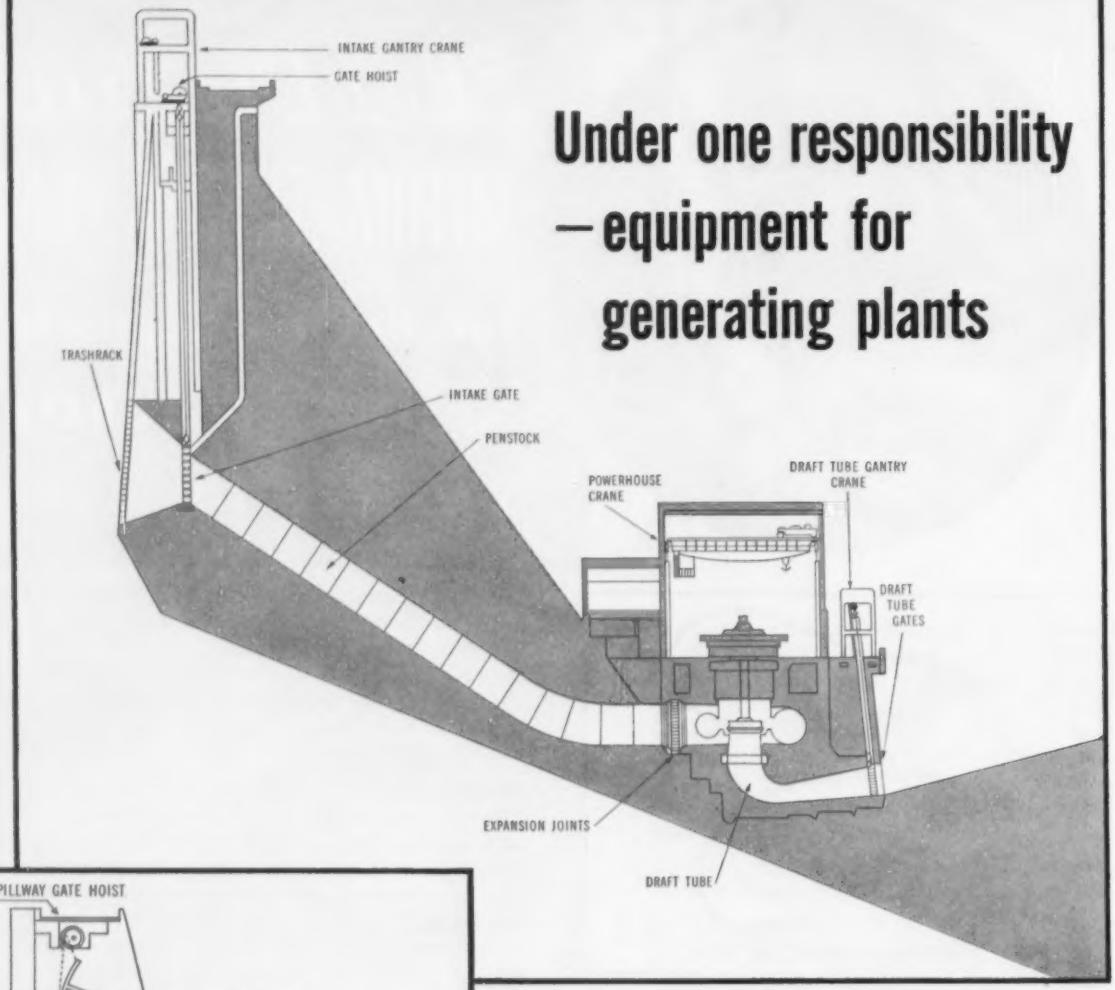
TALENT TO ORIGINATE
E
ABILITY TO PRODUCE

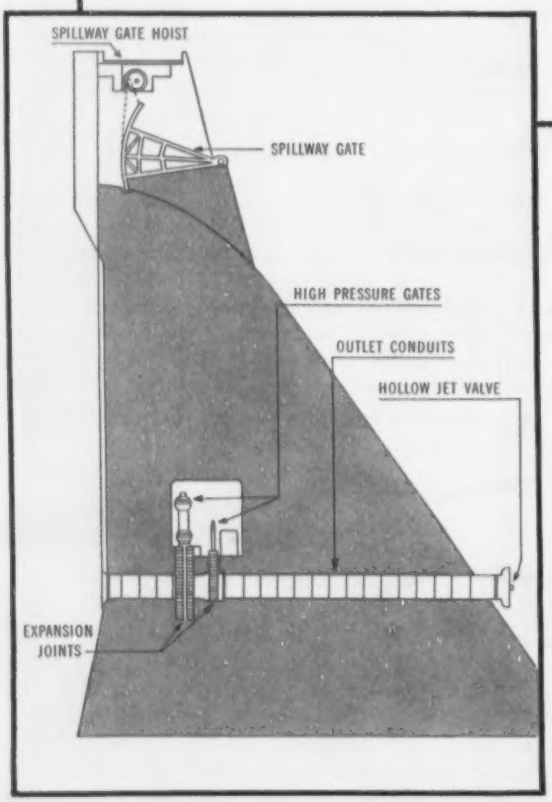
Electroline Company

4121 South La Salle Street • Chicago 9, Illinois

In Canada: POWERLITE DEVICES, LTD., TORONTO

Under one responsibility —equipment for generating plants





● Under *one* responsibility, Paceco engineers, machines and fabricates many essentials for hydroelectric and steam power plants and waterworks.

You get from *one* source a cost-conscious engineering service and follow-through that eliminates divided responsibility.

Paceco service is available nationwide, at competitive prices, delivered and installed. We invite your inquiries.

PACECO
"TAILORS OF STEEL"
®

Pacific Coast Engineering Company

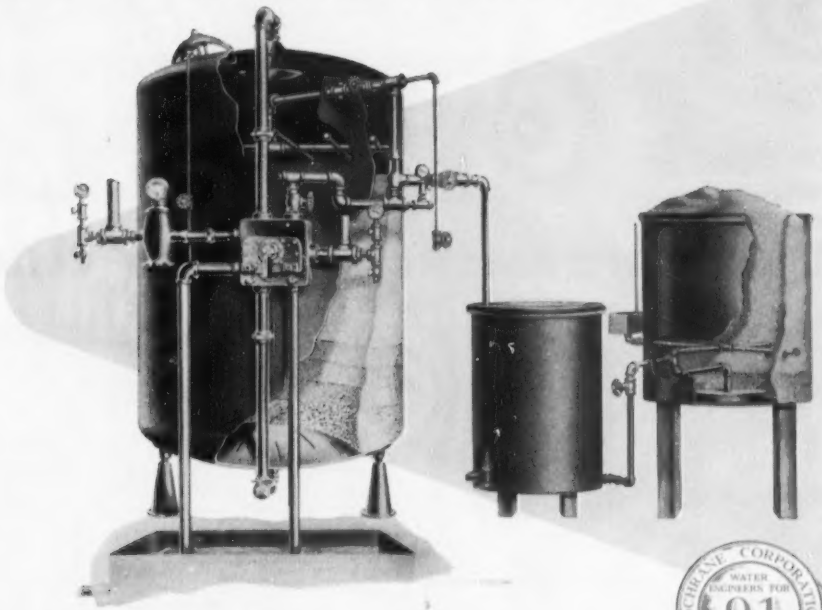
ENGINEERS • MACHINISTS • FABRICATORS

Alameda, Calif. • Phone LAkehurst 2-6100

HIGH EFFICIENCY

Cochrane ZEOLITE SOFTENERS

provide easy, economical operation



The Cochrane Hydromatic Single Control Valve provides positive, accurate control of all phases of the softening and regenerating cycle.

It is so simple to operate that no technical knowledge of the softening process or the equipment is required. High quality effluent is thus assured at a minimum cost and maximum delivery.

Cochrane's 91 years of water conditioning leadership and its complete line of equipment assures you unbiased recommendations for equipment to performance requirements. For the right answer to your water problem, call a Cochrane Engineer today.

Cochrane
CORPORATION

3146 N. 17th STREET, PHILADELPHIA 32, PA.

In Canada: Canadian General Electric Co., Ltd., Toronto
In Mexico: Babcock & Wilcox de Mexico, S.A., Mexico City
In Europe: Recuperation Thermique & Epuration, Paris
In Cuba: Laurence E. Daniel, Inc., Havana
In South America: Servicios Electricos, C.A. (S.E.C.A.) Caracas, Venezuela
In Puerto Rico: F. A. Ortiz & Co., San Juan 5
In Hawaii: Hawaiian Electric Supply Co., Honolulu.

COCHRANE CORPORATION
3146 N. 17th STREET, PHILADELPHIA 32, PA.

Please send me a copy of your Publication 4520-A on your Zeolite Softeners with the Cochrane Hydromatic Single Control Valve.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

Hot Process Softeners | Deaerators | Dealkalizers | Demineralizers | Reactors | Continuous Blow-Off | Specialties | C-B Systems

FOR TOP PERFORMANCE IN EVERY CLIME . . .

WIRE COVERED WITH BAKELITE POLYETHYLENE

TRADE-MARK

Blazing sun . . . sub-zero cold . . . desert or seacoast—it's all the same to BAKELITE Polyethylene wire covering compounds! They stay tough and flexible at −70 deg. C. . . . withstand deformation in heat as high as 90 deg. C. BAKELITE Polyethylene won't festoon. It resists salt spray, moisture, mildew, oil, grease, alkalies, most strong acids. Tests with the black compound show a service life of several decades.

Experience shows BAKELITE Polyethylene speeds wire installation. Superior mechanical properties permit smaller diameters—for easier handling. Wax-smooth, it makes pulling and stripping easier.

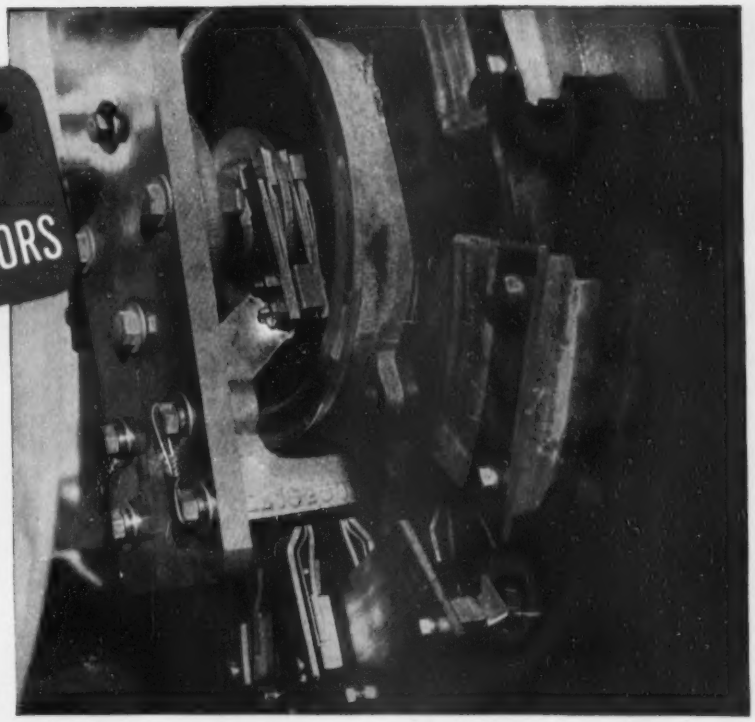
To get complete facts on BAKELITE Polyethylene wire covering compounds write Dept. WZ-63. Ask for Kabelitems No. 48.

BAKELITE
TRADE-MARK
Polyethylene
WIRE COVERING

BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y.
In Canada: Bakelite Company, Division of Union Carbide Canada Limited, Belleville, Ontario

ALLIS-CHALMERS

5/8% STEP VOLTAGE REGULATORS



AFTER 17 YEARS' OPERATION

Practically No Wear!

The unretouched photo above shows the condition of the tap changer from an Allis-Chalmers power regulator that has changed taps 1,240,000 times on a western utility.

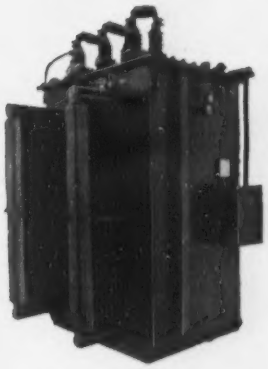
You can see from this photo that this regulator is still in excellent condition — it will give many more years of satisfactory service.

This 17-year operating record adds field proof to laboratory tests that have shown that the *Quick-Break* mechanism will withstand five million operations. You get this rugged, reliable mechanism on every Allis-Chalmers ⅝% step voltage regulator. It gives fast, clean wiping action that snaps moving contacts from one stationary contact to the next before there is time for damage to occur.

In addition, when you depend on Allis-Chalmers, you benefit from more than twenty years' experience building ⅝% step voltage regulators. No other manufacturer gives you this kind of design and operating experience.

Next time you consider regulation, for new or replacement installations, it will pay to get the complete facts about Allis-Chalmers regulators. Contact your nearby A-C district office or write Allis-Chalmers, Milwaukee 1, Wisconsin, for more details. A-4242

Single-Phase Power Regulator



Three-Phase Power Regulator

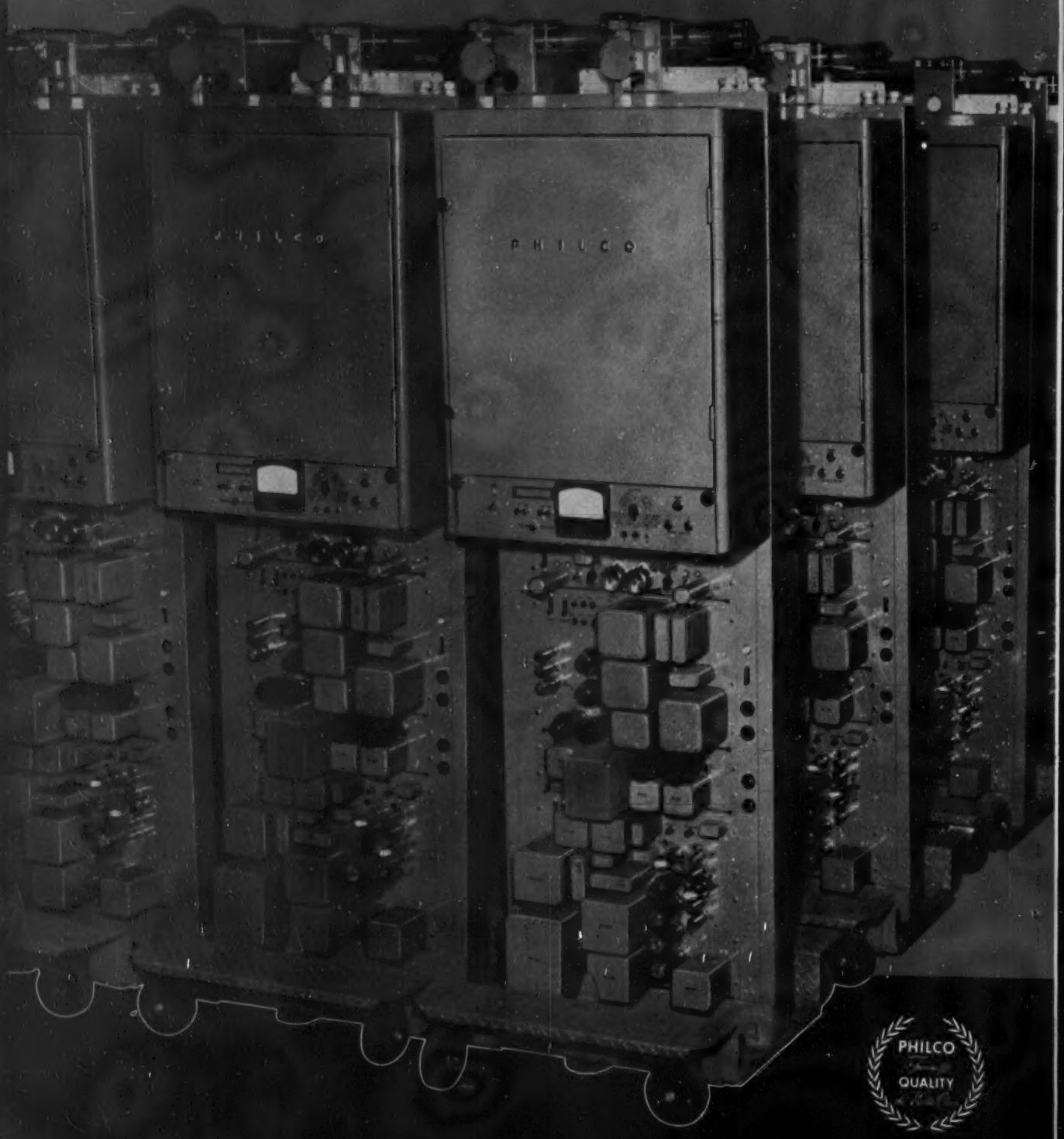
Single-Phase Distribution Regulator

ALLIS-CHALMERS

Originators of ⅝% Step Regulation

PHILCO...

...HAS BUILT AND SHIPPED OVER



PHILCO
QUALITY

1000 MICROWAVE EQUIPMENTS

More than ALL OTHER Manufacturers Combined!

As the world's leading supplier of microwave, Philco has manufactured and delivered nearly 1400 complete microwave equipments...enough to span the nation five times—*or to privately link New York and Hong Kong!* Philco has built and shipped more microwave systems than all other manufacturers combined.

Philco has the distinct advantage of a world-wide installation and service organization, and an experienced system-planning department. These valuable facilities enable Philco to obtain first-hand information on the operation of existing installations, improve equipment, and thus supply new microwave systems which assure the greatest economy and dependability in performance.

This is one reason why Philco microwave is the preference of industry—*good reason why Philco is the world's leading manufacturer of microwave equipment.*

Need a speedy and permanent cure for those communication headaches? Then consider microwave . . . and when you do, specify Philco. An experienced Philco representative is ready to serve you.

World's Leading Manufacturer of Microwave Equipment!

For complete details, write to Dept. EW today

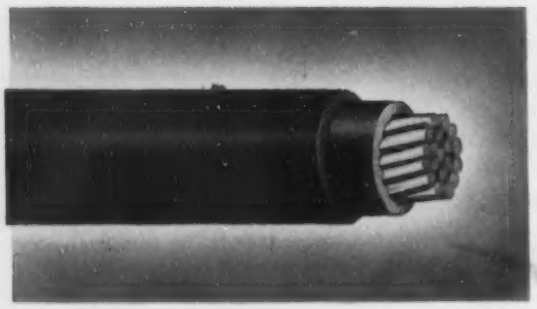
PHILCO CORPORATION

GOVERNMENT & INDUSTRIAL DIVISION PHILADELPHIA 44, PA.

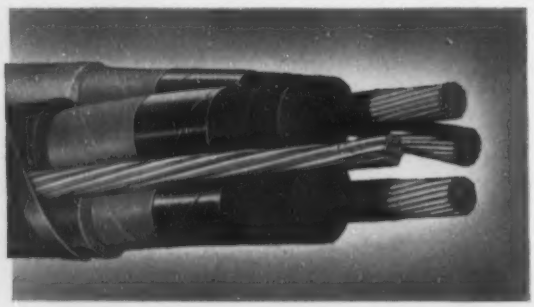
10 reasons why

you should specify, buy,

install U. S. GRIZZLY® POWER CABLES



U. S. Grizzly Power Cable, 600 volts – Type RR single conductor, Hydrosec® – S heat- and moisture-resistant insulation, Neoprene jacket.



U. S. Grizzly Power Cable, 15,000 volts – Type RR – 3-conductor, Uskorona® – ozone-resistant insulation – shielded – Neoprene jacket.

1. Lighter in weight than lead-sheathed cables and lead-sheathed armored cables.
2. Greater flexibility
3. Easier to handle during installation
4. Easier to splice, tap and terminate
5. More resistant to chemical corrosion
6. Unaffected by stray currents
7. Better protection against weathering
8. Longer life
9. Cost less
10. Made by United States Rubber Company, the *only* electrical wire and cable producer to grow its own natural rubber, make its own synthetic rubber and manufacture its own plastics

U. S. Grizzly Power Cables are used for general power distribution, and can be installed in conduits, underground ducts, buried directly in the ground, or installed aerially. Neoprene jacket protects against acids, alkalies, oils, and mechanical damage and weathering. (All IPCEA and NEMA specifications complied with.)

Write to address below for free copy of illustrated reference manual on U. S. Electrical Wires and Cables for the electric utility industry. It lists the type of cable best suited for specific requirements.

US RUBBER

UNITED STATES RUBBER COMPANY

ELECTRICAL WIRE AND CABLE DEPARTMENT, ROCKEFELLER CENTER, NEW YORK 20, N. Y.

"TRANSFORMERS?

We know how to make 'em right at Central!" says Tommie Blevins, a skilled worker of long experience

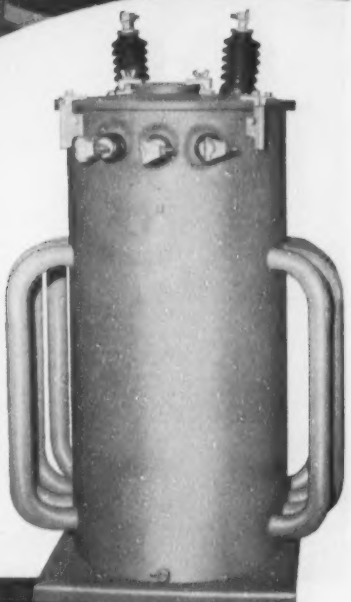
7 Reasons for superiority of Central Transformers

1. *Skilled, Conscientious Workmanship*
2. *Tried-and-Proven Dependability*
3. *Trouble-Free Performance*
4. *Minimum Maintenance*
5. *Long Life*
6. *Reputation—Thousands in Use*
7. *Prompt, Efficient Service*

A TYPE FOR EVERY NEED

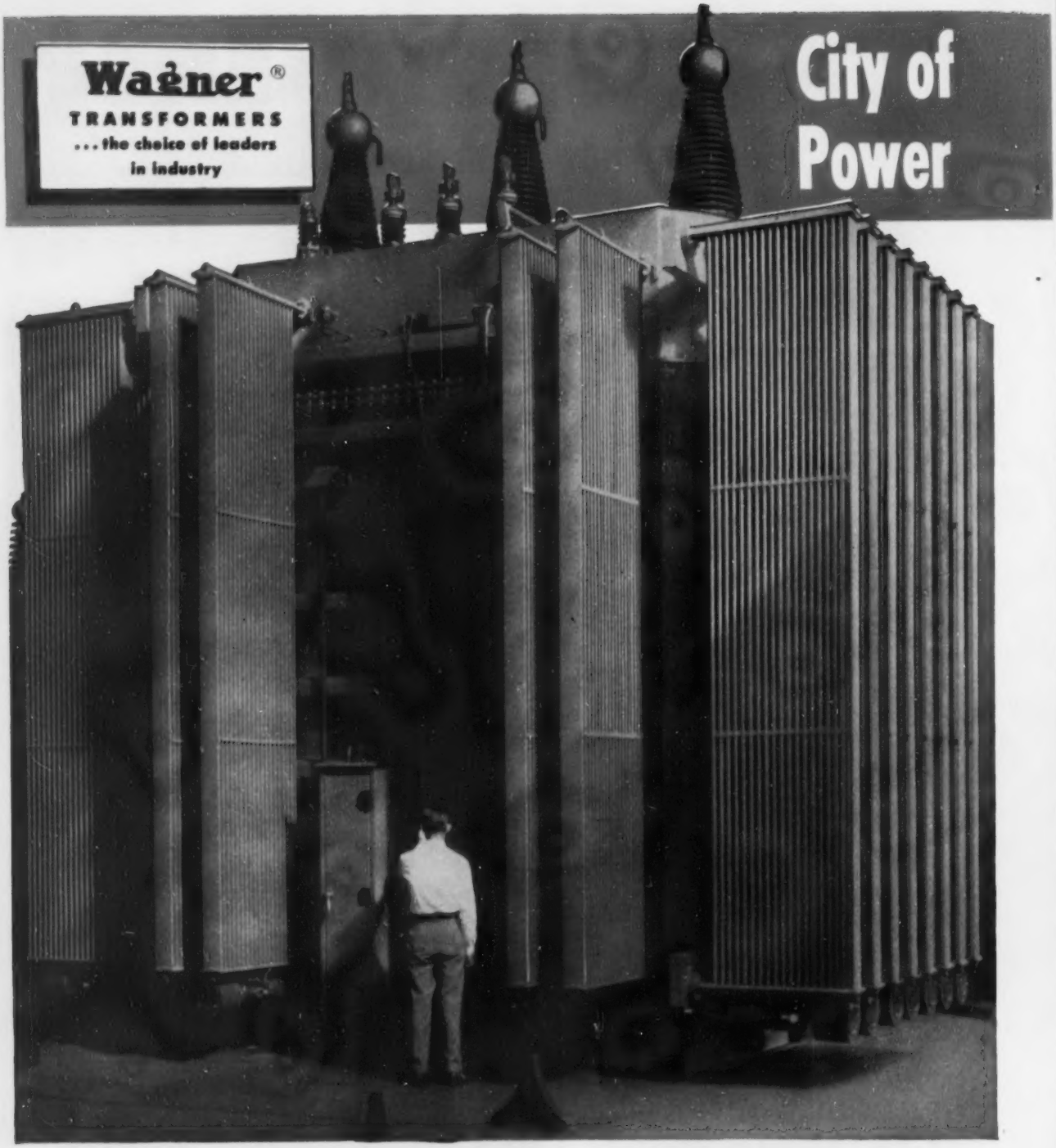
Transformers in sizes from 3 KVA to 10,000 KVA, up to 115 KV primary class.

POLE TYPES: Manufactured in sizes from 3 through 100 KVA, 15 KV primary class, for direct pole mounting, or for use with crossarm hangers . . . illustrated at right is 50 KVA two cover bushings.



Central CTC
TRANSFORMER CORP.

PINE BLUFF, ARKANSAS
SALES OFFICES IN PRINCIPAL CITIES



This Wagner Power Transformer is one of two installed in Tacoma, Washington. Each is rated 30,000/37,500/50,000 kva, class OA/FA/FA three-phase, 60 cycle, 105000Y to 13,800 volts.

Wagner Electric Corporation
EST. 1891

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

T54-4

Tacoma installs two new Wagner Transformers to supply growing loads

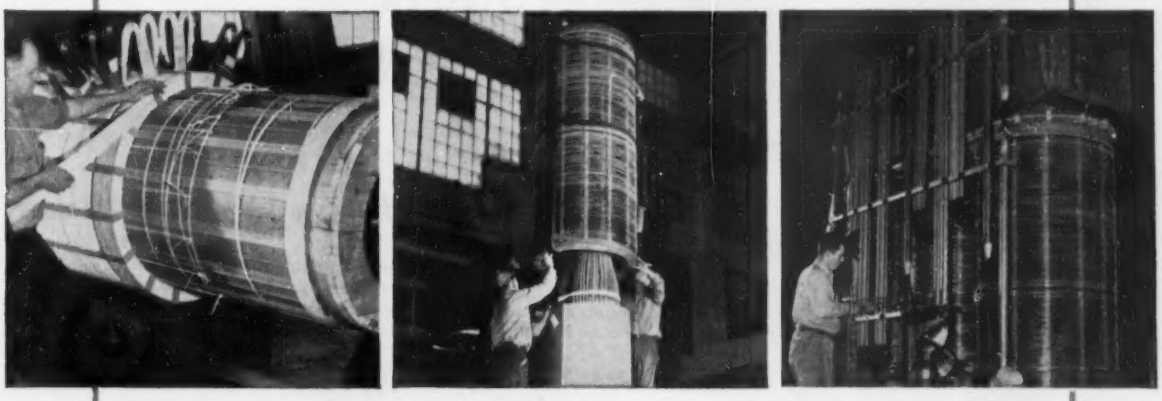
The Tacoma, Washington, Department of Public Utilities has recently installed two new Wagner Power Transformers each rated 30,000/37,500/50,000 kva, class OA/FA/FA, as part of an expansion program to help supply its constantly growing power load.

Wagner Transformers were chosen by the City of Tacoma, as they are by many power companies, because of their reputation for adequate and reliable service.

Wagner has been building power transformers for more than sixty years. The knowledge gained and the facilities acquired in all those years make the building of fine power transformers part of the day's work at Wagner.

Years of engineering "know-how"—Wagner's insistence on the use of only the highest quality materials—carefully controlled production methods—rigid inspections and tests all combine to assure users power transformers that will provide utmost reliability and service continuity.

Wagner's newly increased facilities now permit the manufacture of power transformers in ratings to meet your needs. It will pay you to consult Wagner on your next power transformer installation.



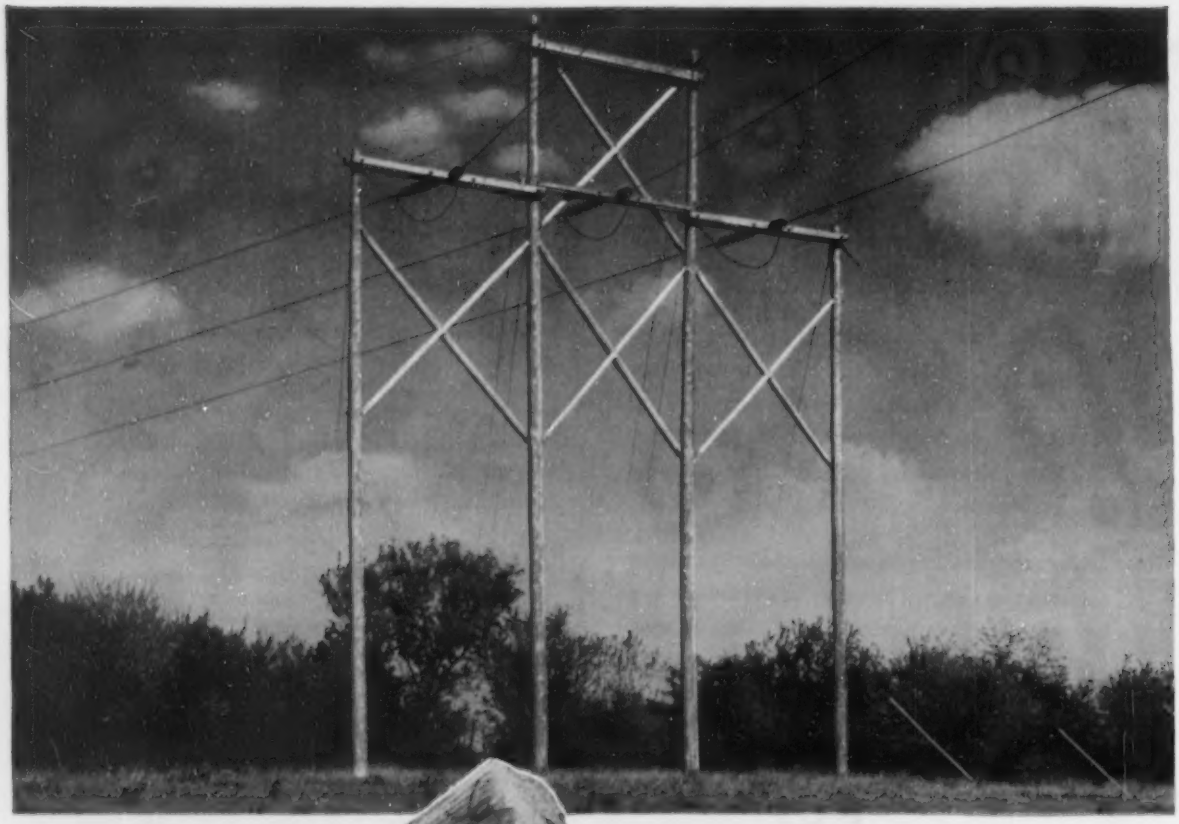
Every step in the construction of Wagner Power Transformers receives special attention. Three operations are shown above. Highly skilled workers wind a low voltage coil, carefully place a high voltage stack into position, and make the final connections on a core and coil assembly.

Thirty-two branch offices, located in principal cities, are at your service. Bulletins TU-180 and TU-181 give information on the complete line of dependable Wagner Transformers.

WAGNER ELECTRIC CORPORATION

6456 Plymouth Ave. • St. Louis 14, Mo., U. S. A.

BRANCHES IN 32 PRINCIPAL CITIES



Section of 15 Year test plot at Consolidated Minneapolis Plant

LONGER POLE-LINE SERVICE

begins with

LIFE-SPAN

research . . . testing . . . experience!

Endless, tireless laboratory research—test plots—poles in line under severe conditions for fast deterioration—years of development and research! Out of these have come the greatest pole treatment ever developed. LIFE-SPAN, the top-to-butt treatment permits power-line poles to defy age, weather, fungi—to give years and years of added trouble-free service.

Take nature's best (Western Red Cedar), add LIFE-SPAN "know-how" and you have unmatched pole life. Assure yourself of far lower yearly maintenance and replacement costs. Specify LIFE-SPAN Western Red Cedar Poles on your next construction job. They're clean, they're safe—*They're Tops!*

CONSOLIDATED TREATING CO.

MINNEAPOLIS, MINNESOTA

Life-Span

Sold only by the following:

- **Schaefer-Hitchcock Co., Sandpoint, Idaho**
  (Suppliers for Joslyn Mfg. & Supply Co.)
- **Naugle Pole & Tie Corp., Chicago, Illinois**
- **Page & Hill, Inc., Minneapolis, Minnesota**
  50 Church St., New York, N. Y.
- **B. J. Carney & Co., Spokane — Minneapolis**

Type HPS
DISCONNECTING SWITCHES

featuring

IMPROVED R&IE SPOT PRESSURE CONTACTS

Designed for the Thermal and Electromagnetic effects of normal high current and fault currents.

STRAIGHT-LINE CURRENT PATH of 100% conductivity materials —a distinctive feature found on R&IE high current switches.

Check the Facts

1. GREATER SHORT CIRCUIT CAPACITY throughout entire switch.
2. HI-PRESSURE SPOT SILVER - TO - COPPER CONTACTS — staggered, coined contact spots on each finger result in consistent blade thickness permitting greater thermal capacity.
3. BLADE-END TINES—Blade end cut into tines or fingers to permit each contact spot to carry full pressure from individual pressure fingers.
4. BERYLLIUM COPPER PRESSURE FINGERS—for high conductivity and proper application of strength and resiliency.
5. HI-PRESSURE HINGE CONTACTS—uniform pressure in all blade positions through annular, line contact blade surface.
6. SILVER-PLATED TERMINALS.
7. EASY BLADE OPERATION—through sequential blade movement. Contact pressure released from inside pair of blades before outside pair start travel.

R&IE SWITCHING EQUIPMENT

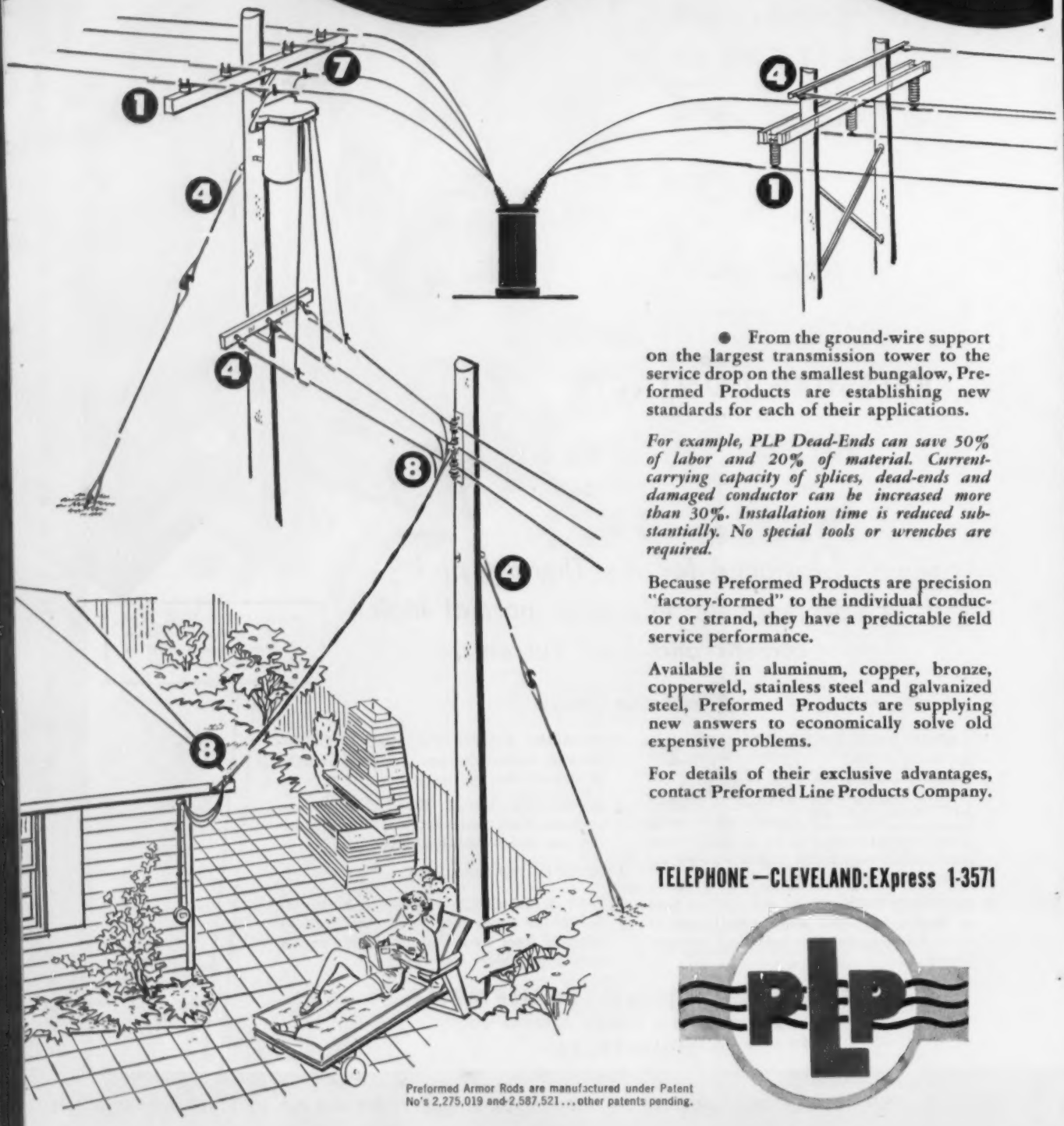
DIVISION OF I-T-E CIRCUIT BREAKER CO.

GREENSBURG, PA.

STRUCTURES: steel or aluminum ● TESTING DEVICES ● KIRK KEY INTERLOCK SYSTEMS ● ISOLATED PHASE BUS STRUCTURES ● INTERRUPTER SWITCHES

INDOOR BUS SUPPORTS and BUS FABRICATION ● OUTDOOR BUS SUPPORTS and AIR SWITCHES ● SUBSTATION

"Preformed" MEANS SAVINGS



● From the ground-wire support on the largest transmission tower to the service drop on the smallest bungalow, Preformed Products are establishing new standards for each of their applications.

For example, PLP Dead-Ends can save 50% of labor and 20% of material. Current-carrying capacity of splices, dead-ends and damaged conductor can be increased more than 30%. Installation time is reduced substantially. No special tools or wrenches are required.

Because Preformed Products are precision "factory-formed" to the individual conductor or strand, they have a predictable field service performance.

Available in aluminum, copper, bronze, copperweld, stainless steel and galvanized steel, Preformed Products are supplying new answers to economically solve old expensive problems.

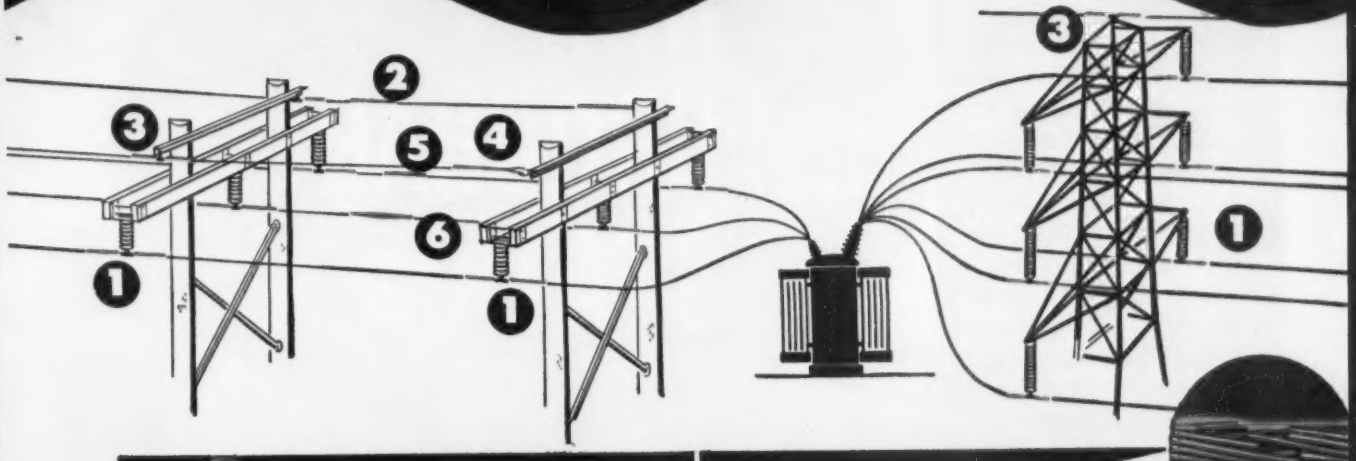
For details of their exclusive advantages, contact Preformed Line Products Company.

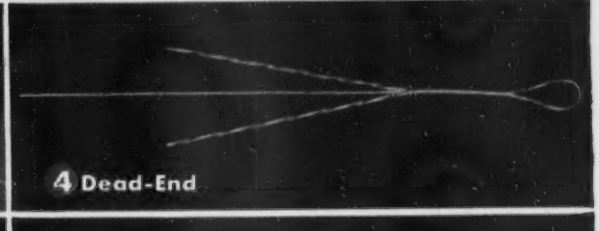
TELEPHONE—CLEVELAND: EXpress 1-3571

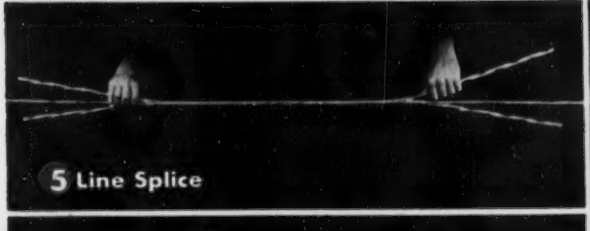
PLP

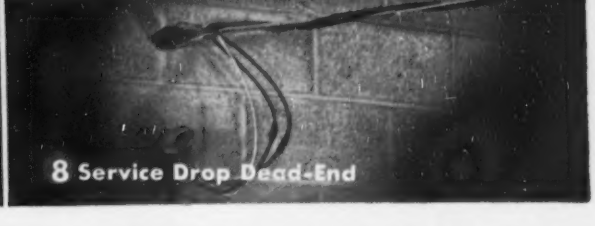
Preformed Armor Rods are manufactured under Patent No's 2,275,019 and 2,587,521 . . . other patents pending.

ALL ALONG THE LINE . . . . .









PREFORMED LINE PRODUCTS CO.

5349 ST. CLAIR AVENUE CLEVELAND 3, OHIO

NEW UTILITY STATIONS C-E EQUIPPED

Includes stations placed in operation since the war (in white) and those under construction or being engineered.

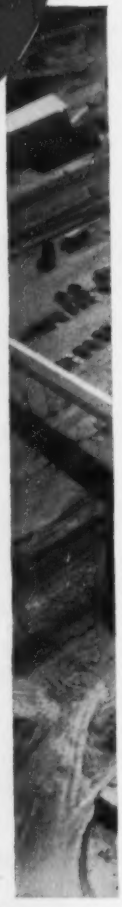
TIDD • JENNISON
CECIL LYNCH • HAVANA
MEREDOSIA • PERMIAN BASIN
O. H. HUTCHINGS • REX BROWN
HICKLING • B. C. COBB
RUSSELL • SEWAREN
POSSUM POINT • CUTLER
PORT JEFFERSON • WHITE RIVER
POTOMAC RIVER • GADSDEN
W. SPRINGFIELD • WOOD RIVER
DAN RIVER • LAKE CATHERINE
HARRY NEWMAN • JIM HILL
HUTCHISON • YATES
DUNKIRK • TITUS • LEE
CONTRA COSTA • HAWTHORN
NINEMILE POINT • EDGE MOOR
PALATKA • JOHNSONVILLE
DANSKAMMER • BECKJORD
HIGHGROVE • PLANT X
BLACK DOG • ALBANY
JOPPA • MERAMEC
PORTSMOUTH • LAKE CREEK
ETIWANDA • AURORA
HENNEPIN • EASTLAKE
OAK CREEK
SUWANNEE RIVER

URQUHART

SANDOW
KINGSTON
BARRY
MULLERGREN
NORTH OMAHA
SAGUARO
MILLIKEN
NELSON
WILMINGTON
JOHN SEVIER
VERMILION
GALLATIN
BARRETT
CARBON

NEW URQUHART STATION

goes into service



Units 1 & 2 at the Urquhart Station of the South Carolina Generating Co. were placed in commercial operation on December 7, 1953 and February 7, 1954. The South Carolina Generating Co. is a wholly owned subsidiary of the South Carolina Electric and Gas Company.

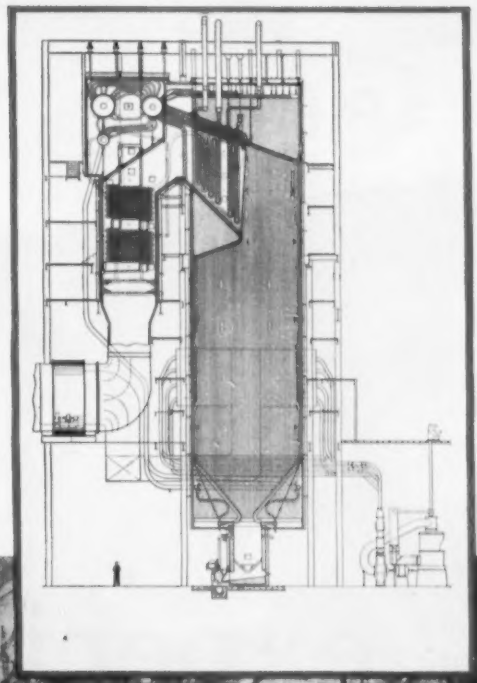
Located on the Savannah River, 20 miles southwest of Aiken, South Carolina, and 4 miles below Augusta, Georgia, this station is the latest addition to the rapidly growing system of the South Carolina Electric & Gas Company. This is the eighth generating station of the system which now has a total generating capacity of 536,140 kw.

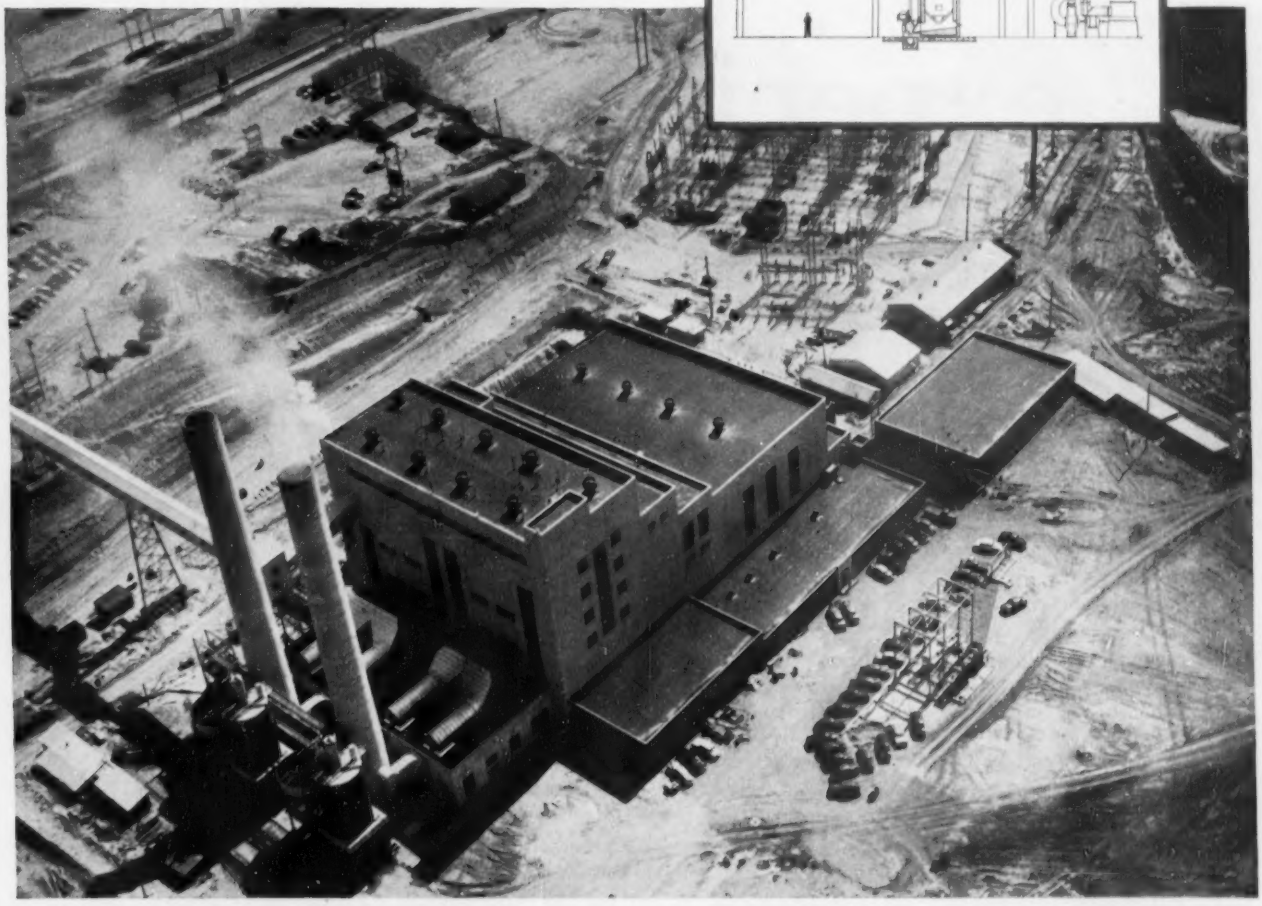
The two turbine-generators now in service are identical, with a maximum rated capacity of 75,000 kw each. They are designed to operate at a throttle pressure of 1450 psi with a primary steam temperature of 1000 F, reheated to 1000 F. Each turbine generator, boiler and auxiliaries are designed for "unit system" operation. A third unit of 100,000 kw maximum rated capacity is now under construction and is scheduled for operation in 1955. Gilbert Associates, Inc. are the consulting engineers.

All three turbine generators in this new station are served by C-E Steam Generating Units. A brief description and a cross sectional elevation for boilers 1 & 2 appear on the opposite page.

B-744

The C-E Unit show at the right is one of two duplicates now in service at the Urquhart Station. They are of the radiant-reheat type with the reheater section located between the primary and secondary superheater surfaces. Economizer surface is located below the rear superheater sections and regenerative air heaters follow the economizer surface. Pulverized coal firing is employed, using bowl mills and tilting, tangential burners. Provision is made to use oil as an alternate fuel.



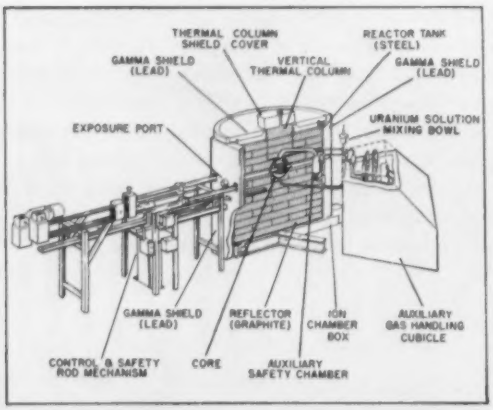


COMBUSTION ENGINEERING

Combustion Engineering Building, 200 Madison Avenue, New York 16, N. Y.

BOILERS, FUEL BURNING & RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS & FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS; SOIL PIPE

Water boiler reactor designed and built by North American



put this **experience**

to work for you in nuclear reactor development

Since 1948 North American Aviation has been a prime contractor to the Atomic Energy Commission.

Research Reactors have been designed and built by North American for AEC contractors.

A complete program of engineering development including design, evaluation and experimentation has been conducted for production and power reactors.

An integrated program for investigations in nuclear science, reactor materials, radiochemistry and other allied fields is currently underway.

Experimental Nuclear Reactor designed and built by North American

North American Aviation invites your inquiry regarding reactor development or any other project in which atomic energy can be put to productive use. As in the case of proposals now in process, North American will provide all engineering services necessary for reactor development and operation—insuring the widest possible range of reactor application.

Each phase of the North American reactor development program is supported by a highly integrated, skilled organization working with the most advanced equipment available . . . providing extensive atomic energy research and production facilities.

All reactor development is undertaken in accordance with the provisions of the Atomic Energy Act and subject to approval of the Atomic Energy Commission. Please address your inquiry to: NORTH AMERICAN AVIATION, INC., Atomic Energy Research Department, Downey, California.

organization, facilities and experience keep **North American Aviation** *years ahead*

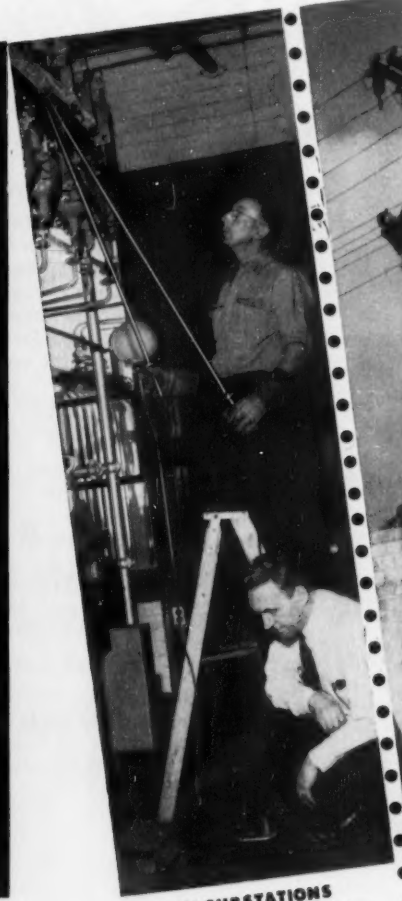
in aircraft . . . atomic energy . . . electronics . . . guided missiles . . . research and development

"Hipot sticks cut our phasing time 50%," says Utility Chief Operator.

"Every line truck should have a phasing stick", says Utility Line Foreman.

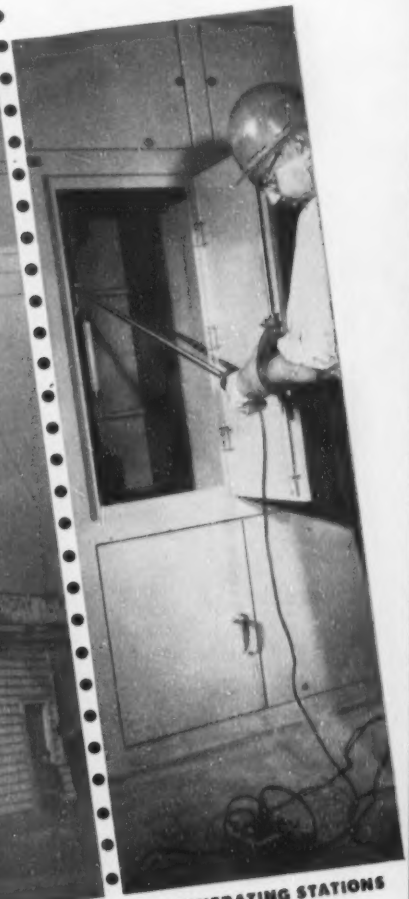
"Handiest thing we've had for phasing," says Meter Relay Engineer.

these three utility men agree



IN SUBSTATIONS
checking phase rotation

ON LINE JOBS
phasing between lines



IN GENERATING STATIONS
checking phase rotation

C-L-M Hipot phasing sticks save time

Looking for ways to get more jobs done, easier, in less time? These three Canadian utility men can tell you how. By using C-L-M Hipot phasing sticks they save time on jobs like: phasing between circuits, finding phase rotation, testing to see whether lines are alive or dead, locating accidental grounds on non-grounded systems.

They find these light, well-balanced sticks are *handy to use* from the pole or on the ground.

And they find these sticks are *safe to use.* Sticks can be used on live lines up to 33kv.

They find these sticks are *accurate* too. Special high voltage resistors guarantee accurate readings.

Find out for yourself! For full information write . . .

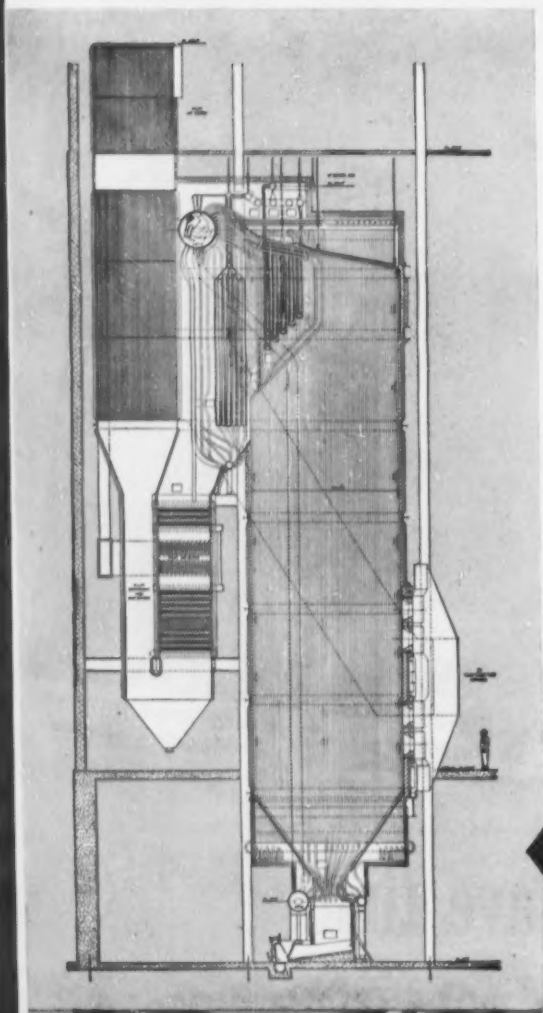
PORTABLE

CANADIAN LINE MATERIALS LIMITED

TORONTO 13, CANADA

RILEY Established

Eight Public Utilities in Four Midwest States



600,000 lbs./hr. Riley unit at R. S. Wallace Station operates at 950 psig and 900°F.

Steam drum for one of two 300,000 lbs./hr. Riley units being erected at Marshalltown, Iowa for Iowa Electric Light & Power Co.

Illinois

Central Illinois Light Company

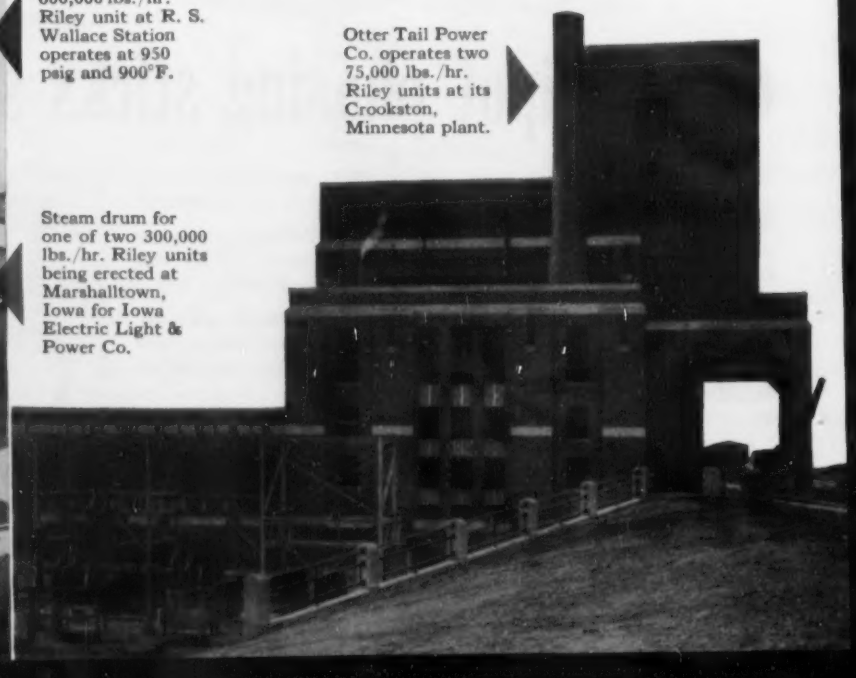
The new 600,000 lbs./hr. steam generating unit at R. S. Wallace Station is the fifth and largest high pressure Riley unit installed in this station. Since November 1952, when it was placed in operation, this unit has been available 98% of the time. It is designed for efficient burning of Central Illinois strip mine coal.

Iowa

Iowa-Illinois Gas & Electric Co.
Iowa Electric Light & Power Co.
Iowa Public Service Co.
Interstate Power Co.

These four Iowa public utilities have purchased a total of eighteen Riley units for a combined total of 3,585,000 pounds of steam, or a generating potential of over 300,000 kilowatts.

Otter Tail Power Co. operates two 75,000 lbs./hr. Riley units at its Crookston, Minnesota plant.



with Midwest Utilities

are Regular, Satisfied Users of Riley Equipment

Indiana

Public Service Co. of Indiana, Inc.

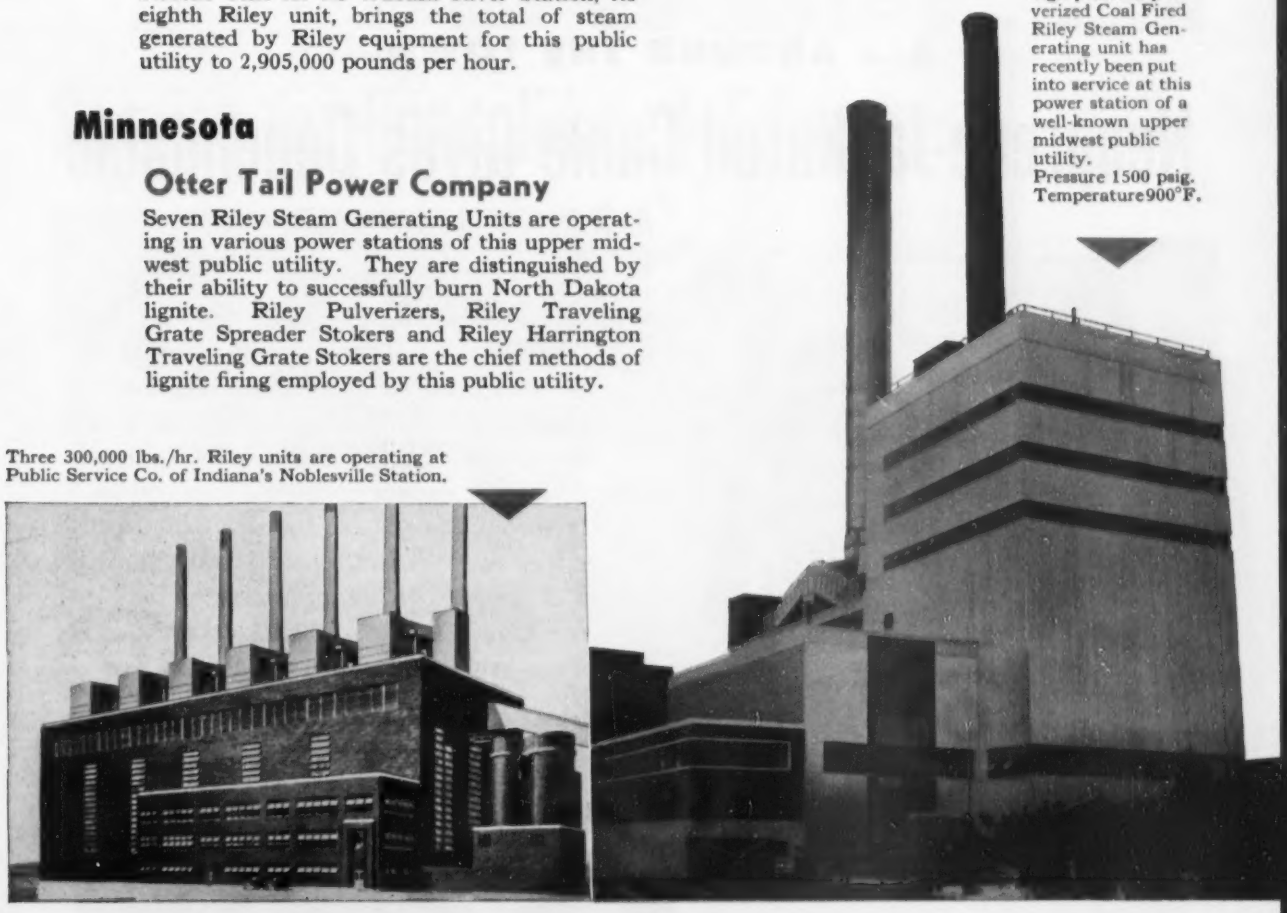
The recent purchase of an 805,000 lbs./hr. Reheat Unit for its Wabash River Station, its eighth Riley unit, brings the total of steam generated by Riley equipment for this public utility to 2,905,000 pounds per hour.

Minnesota

Otter Tail Power Company

Seven Riley Steam Generating Units are operating in various power stations of this upper midwest public utility. They are distinguished by their ability to successfully burn North Dakota lignite. Riley Pulverizers, Riley Traveling Grate Spreader Stokers and Riley Harrington Traveling Grate Stokers are the chief methods of lignite firing employed by this public utility.

A 385,000 lbs./hr. high pressure pulverized Coal Fired Riley Steam Generating unit has recently been put into service at this power station of a well-known upper midwest public utility.
Pressure 1500 psig.
Temperature 900°F.



Three 300,000 lbs./hr. Riley units are operating at Public Service Co. of Indiana's Noblesville Station.

TRADE MARK Rx REGISTERED

RILEY
STOKER CORPORATION

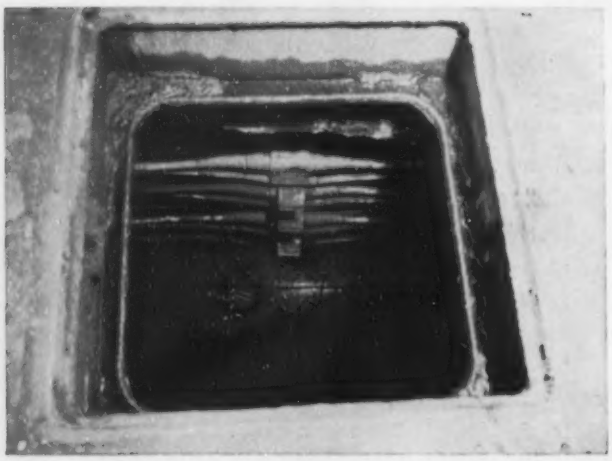
WORCESTER, MASS.
Boston, New York, Philadelphia, Buffalo, Washington, Pittsburgh, Cleveland, Detroit, Chicago, Cincinnati, Charlotte, New Orleans, Atlanta, St. Louis, Kansas City, St. Paul, Tulsa, Houston, Denver, Salt Lake City, Los Angeles, San Francisco, Portland, Seattle

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • ECONOMIZERS
WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

ALL AROUND THE TOWN—

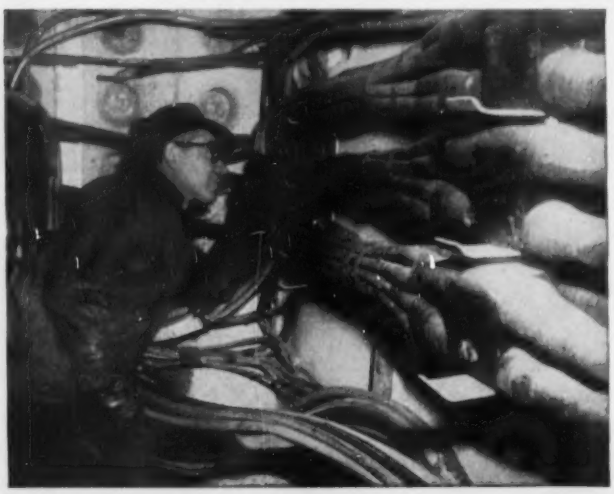
Neoprene-Jacketed Cable Gives Dependable

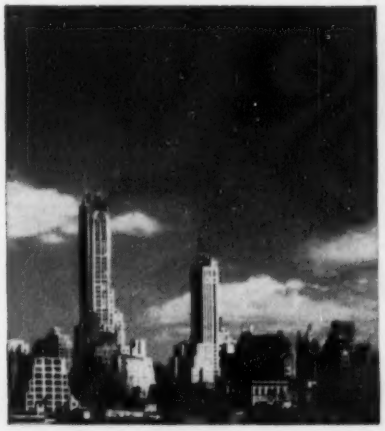


Downtown: 3½ feet of salt water were pumped out of this manhole to reveal neoprene-jacketed secondary network cables that supply piers and buildings along New York's East River with 120/208V service. High tide floods the ducts and covers these cables 3 hours out of every 24, exposing them to oily grime, river silt and abrasive foreign matter. Yet Con Edison inspectors report that the neoprene jacketing is still in good shape after many years of service!

Midtown:

Nothing is overlooked in careful, routine inspections by Con Edison. In this manhole, an inspector is checking neoprene-jacketed secondary network cable (120/208V—3 phase, 4 wire) used to supply the area around the United Nations Building. He searches the cable jackets for cracks, swollen joints and abrasion at duct edges. With every inspection, neoprene proves that its toughness and durability lengthen cable service life . . . cut maintenance and replacement costs.





Service for Consolidated Edison

Uptown: Con Edison men prepare to pull a length of 3-500,000 CM cable through a duct in The Bronx. They find that the tough neoprene jacketing is flexible and easy to handle . . . speeds pulling operations. And there's no need to "baby" this cable! Neoprene has the abrasion resistance needed to withstand the bite of the "basket" and scuffing during the pull. And its resistance to deterioration from contact with oils and greases permits "soaping" with lubricants.

LEARN FOR YOURSELF, as Con Edison has, how neoprene-jacketed cable *stays* on the job. Your cable supplier will be glad to tell you about the neoprene-jacketed cables available—made in single- and multi-conductor types for a wide range of voltage ratings. And remember, every foot of cable protected by rugged neoprene will resist all common causes of cable failure. That's why you can use it with confidence in ducts, above ground, or buried directly in the earth.

FREE! The Neoprene Notebook

Each issue describes on-the-job reports . . . new, unusual applications of neoprene . . . interesting stories. Send coupon below to get on the mailing list.

NEOPRENE

The rubber made by Du Pont since 1932

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

E. I. du Pont de Nemours & Co. (Inc.)
Rubber Chemicals Division EW-4
Wilmington 98, Delaware

Please put my name on the mailing list to receive the Neoprene Notebook regularly.

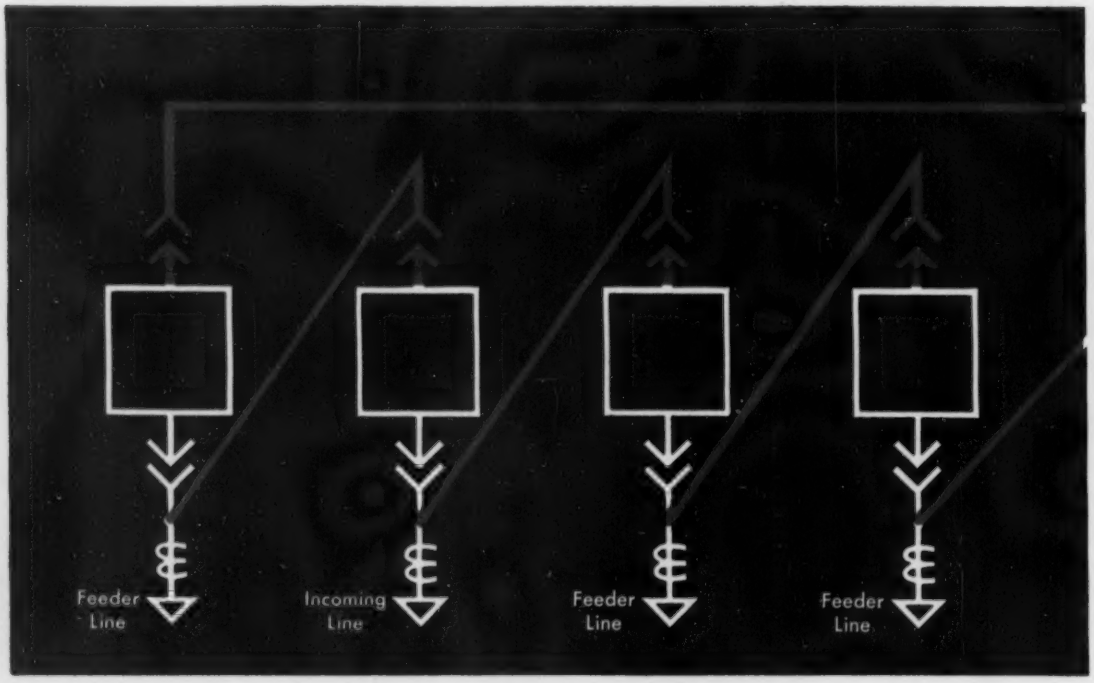
*Name*_____ *Position*_____

*Firm*_____

*Address*_____

*City*_____ *State*_____

USE A FLEXIBLE *Without the*



No costly extra cubicles needed! Ring buses are built into standard units of Allis-Chalmers Metal-Clad Switchgear. This economy, together with their other advantages, makes ring bus schemes more attractive than ever.

Important Advantages

First, there's the flexibility of a ring bus as shown in the single line diagram above. For example, one breaker functions as both a feeder breaker and a bus tie breaker, and it is possible to feed each circuit from either of two breakers. In addition, a ring bus provides continuous service while a circuit breaker is taken out for routine maintenance.

While these advantages can be enjoyed with other circuit arrangements, additional equipment is usually required and it becomes too expensive. As a result, ring bus schemes are often overlooked. But with Allis-Chalmers switchgear a ring bus scheme is simple. The only change from standard construction is the diagonal bus from the front of one unit to the rear of the adjacent unit.

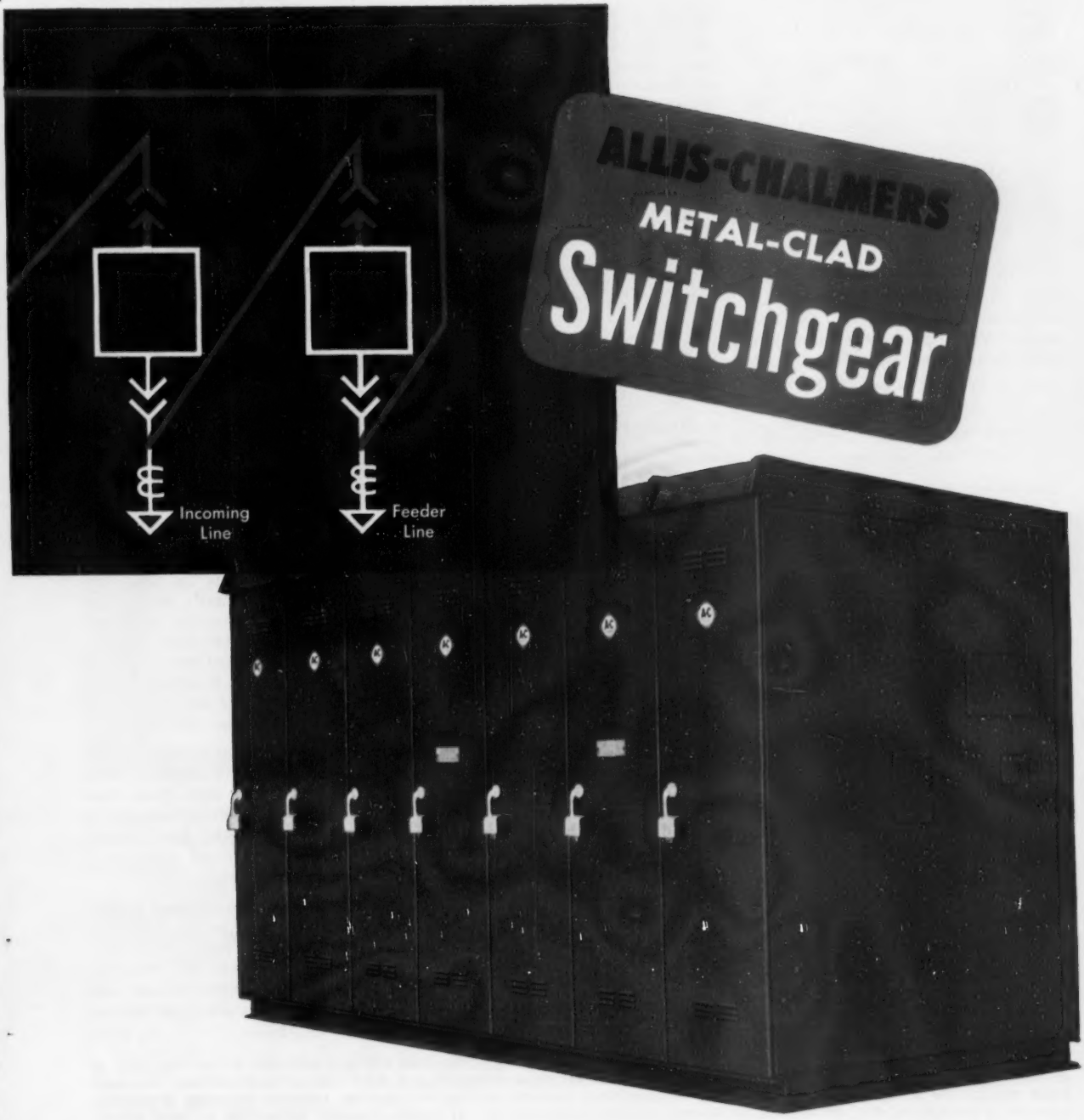
It's time you enjoy the flexibility of a ring bus with Allis-Chalmers switchgear — without the usual high cost.

Talk it over with an A-C engineer. Call your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wis.

A-3991

ALLIS-CHALMERS

RING BUS
Usual High Cost!



(*Advertisement*)

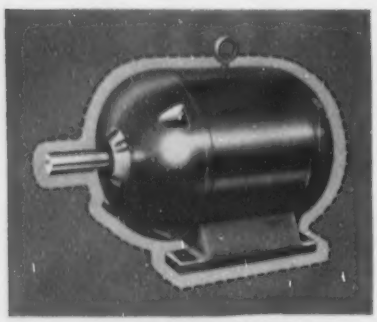
IRVINGTON
INSULATION DIGEST

Thin Slot Insulation Will Save Space in Class "A" Motors

A new type of slot insulation, specially designed to permit reduction in size of motors with Class "A" temperature ratings, will make possible the use of thinner slot cells without sacrifice of the necessary dielectric strength.

This new product of Irvington insulation research consists of a rag paper backing — carefully selected for high mechanical strength and ease of handling — bonded to a polyester film which has the exceptionally high dielectric strength of 4,000 volts per mil, as compared with an average value of 1,200 vpm for the varnished cambric used in conventional types of Class "A" slot insulation.

The dielectric strength of the polyester film allows the use of a much thinner cross-section than would be possible with varnished cambric. Hence the over-all thickness of the slot insulation can be substantially reduced, while the desired voltage breakdown values are maintained.

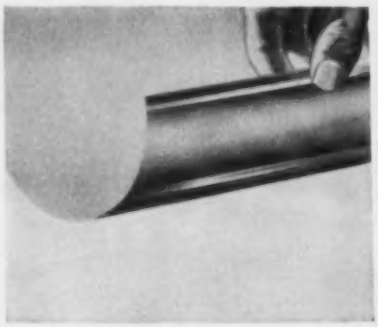


Irvington's new thin high dielectric materials meet the requirements for reduced electrical insulation thickness

New Class "B" Insulation Line Anticipates Smaller-Motor Trend

High-Dielectric Laminations Using 4,000 vpm Film Stand Higher Temperatures than NEMA Standards

Working in close cooperation with motor manufacturers, Irvington has been actively engaged for the past year in the development of a comprehensive line of the Class "B" insulation which will be required in the design of the smaller frame sizes.



First of the new types of Class "B" insulation, introduced by Irvington last year, consisted of various thicknesses of asbestos paper and polyester film, bonded in duplex and triplex combinations. The line has now been expanded to permit limitless combinations of the film and other insulating materials

The first members of this new insulation line, introduced last year by Irvington, consisted of a polyester film with a dielectric strength of 4,000 vpm, laminated to specially selected asbestos papers. A study of the industry's requirements, however, disclosed that laminations of the polyester film with other types of insulating materials would be needed to meet design and service problems. Among the many combinations already developed are: polyester film bonded to pure asbestos, plain or saturated; polyester film bonded to asbestos in which glass fibers have been inlaid for greater mechanical strength; polyester film and woven glass cloth.

Irvington Laminations Using Polyester Film Withstand 150° C.

The Class "B" insulating materials being produced by Irvington withstand continuous operation at 150° C. because of the use of an adhesive specifically developed by Irvington for this purpose.

The adhesive, which is used exclusively in Irvington's own manufacturing processes, bonds a high-dielectric polyester film to any of the other commonly used insulating materials.

This Irvington adhesive is not affected by any of the solvents in the majority of insulating varnishes used for impregnating windings.

Temperature Safety Factor

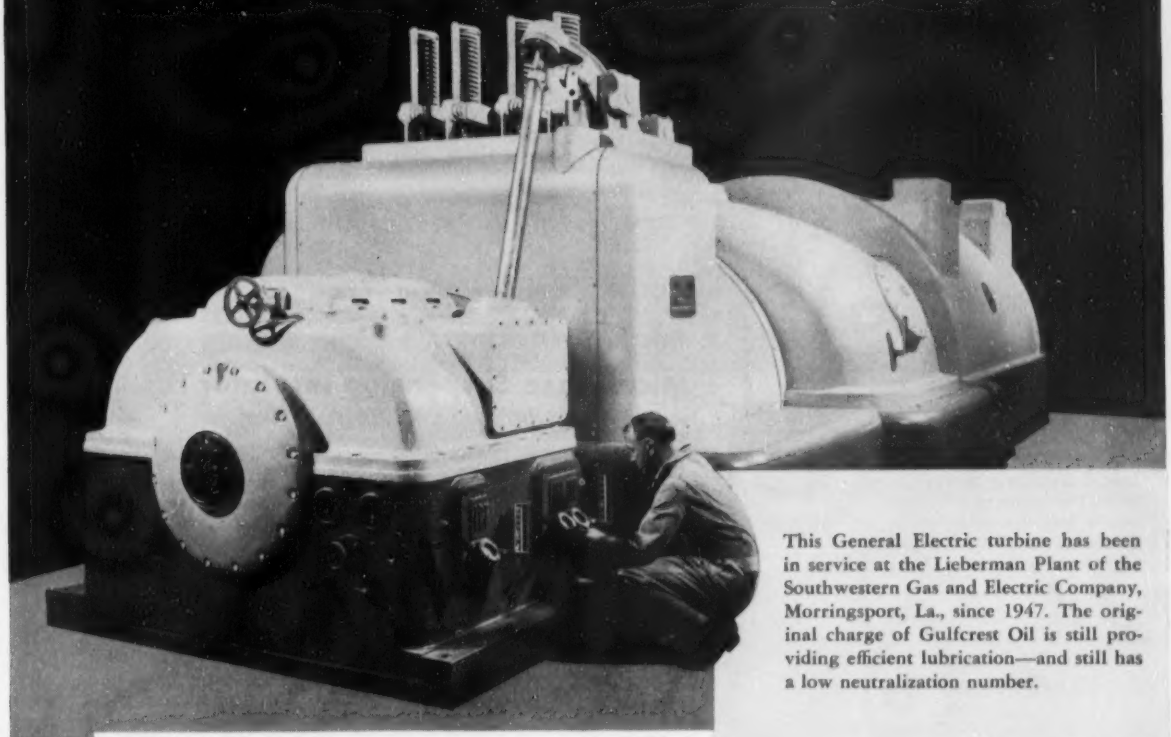
While rated as Class "B" insulations, the products in this new Irvington line actually exceed the temperature limitation standards set by NEMA. Test data indicate that these laminations, bonded with adhesive developed by Irvington, will successfully withstand temperatures up to 150° C.

In addition to operating at the higher temperatures resulting from the smaller frame sizes, these new insulations have the advantage of permitting thinner insulations without sacrifice of electrical breakdown characteristics.

Their ability to withstand higher temperatures and to provide high dielectric strength in relatively thin sections will permit very substantial savings in size, weight and cost, both in transformers and in voltage regulators.

WHILE LAMINATED INSULATIONS INCORPORATING THIS NEW 4,000 VPM POLYESTER FILM ARE NOT EXPECTED TO BE AVAILABLE IN QUANTITY BEFORE THE MIDDLE OF THIS YEAR, IRVINGTON IS INTERESTED IN WORKING OUT WITH YOU A PROGRAM THAT WILL MEET YOUR INSULATION REQUIREMENTS. FOR FURTHER INFORMATION, ADDRESS THE SALES MANAGER, COATING DIVISION, IRVINGTON VARNISH & INSULATOR, DIV. OF MINNESOTA MINING & MANUFACTURING CO., 21 ARGYLE TERRACE, IRVINGTON 11, NEW JERSEY.

the RIGHT oil for every steam turbine – GULFCREST



This General Electric turbine has been in service at the Lieberman Plant of the Southwestern Gas and Electric Company, Morringsport, La., since 1947. The original charge of Gulfcrest Oil is still providing efficient lubrication—and still has a low neutralization number.

the RIGHT base stock, super-refined

the RIGHT combination and concentration of additives

the RIGHT background of performance

Gulfcrest Oil has a background of successful performance in every type and make of steam turbogenerator.

In many of these installations, the original charge of Gulfcrest has been in service more than 15 years with no significant change in its original characteristics, and with neutralization numbers always remarkably low and safe. That is why Gulfcrest Oil is acclaimed "the world's finest turbine oil."

You'll be joining an impressive group of well satisfied users when you fill your turbine system with this outstanding oil.

Call in a Gulf Sales Engineer and ask him to recommend the proper grade. Or write to the Gulf Oil Corporation, 1822 Gulf Building, Pittsburgh 30, Pennsylvania.

Gulf Oil Corporation · Gulf Refining Company

GULF INDUSTRIAL LUBRICATION

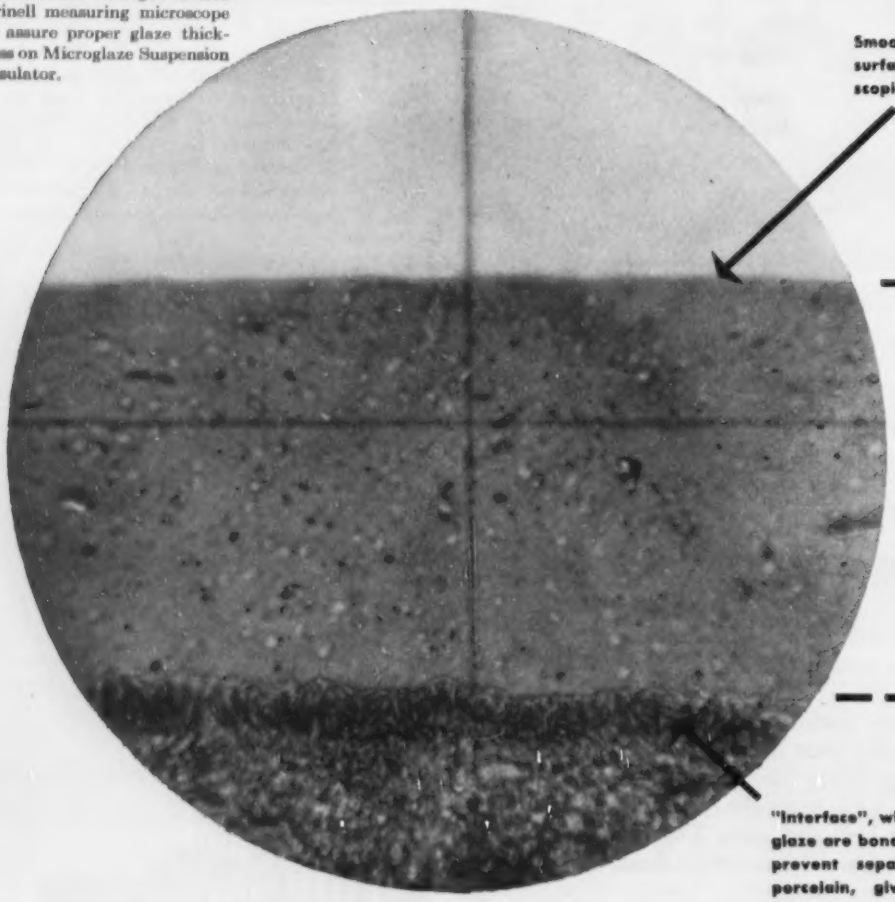
Locke reports new facts about

GLAZE THICKNESS and

Research into their relationship leads Locke to develop . . .

Locke Ceramic Engineer uses Brinell measuring microscope to assure proper glaze thickness on Microglaze Suspension Insulator.

Photomicrograph of cross section near surface of Microglaze Suspension Insulator



Smooth, self-cleaning glaze surface results from microscopic glaze thickness control.

Thickness of glaze, measured between surface and junction with porcelain body is controlled by Locke to achieve peak strength.

"Interface", where porcelain body and glaze are bonded. Interlocking crystals prevent separation of glaze from porcelain, give added strength to Microglaze Insulators.

INSULATOR STRENGTH

NEW MICROGLAZE SUSPENSION INSULATORS

An insulator's ability to withstand mechanical impact varies with thickness of the compression glaze on its surface. Too much glaze . . . or too little . . . will prevent full development of insulator strength.

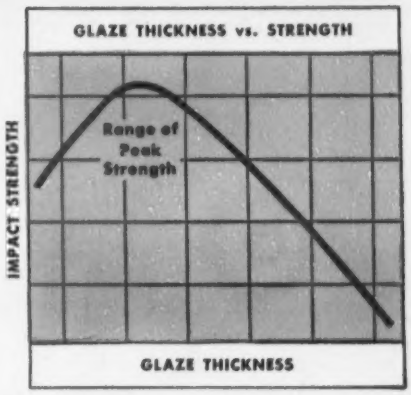
However, laboratory tests show that porcelain with a smooth coat of compression glaze, held within a microscopically narrow range of thickness, will be as much as 40% stronger than improperly glazed porcelain.

Locke has been quick to bring this discovery out of the lab and onto the production line for the benefit of all insulator users.

The result is the new MICROGLAZE Suspension Insulator.

Microscopic control of glaze thickness is now applied to these mass-produced suspension insulators, resulting in uniform peak strength, assuring you a new kind of protection . . . and longer, trouble-free insulator service life.

Next time specify MICROGLAZE Suspension Insulators . . . your best insurance yet against the hazards of mechanical impact.



Research in Locke laboratories proves definite relationship between glaze thickness and both flexural and impact strength of the porcelain. Curve shows how impact strength increases with increasing glaze thickness, reaches peak, then drops sharply. On Microglaze Insulators, glaze thickness is maintained within the narrow range which gives *peak* strength.

Accurate glaze thickness control is accomplished by use of this precision glazing machine. As each insulator spins its way around the wheel, it is cleaned, moistened, glazed, exactly the same way as every other. This, combined with special control of many other factors assures uniform appearance, uniform top strength, uniform reliability.

Send today for new 8-page folder titled "The Story of Microglaze Insulators"

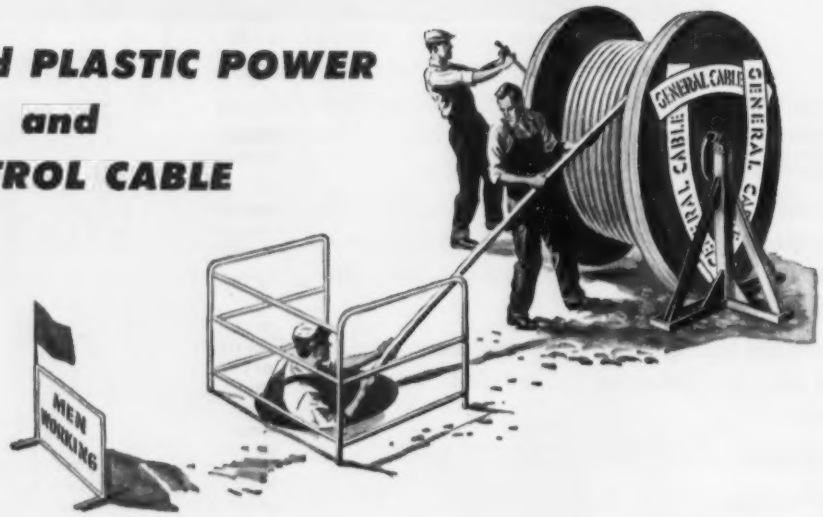
LOCKE

LOCKE DEPARTMENT
GENERAL ELECTRIC COMPANY
BALTIMORE, MARYLAND

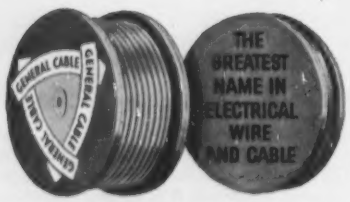
*Trademark of General Electric Company

THE GREATEST NAME IN ELECTRICAL WIRE AND CABLE

RUBBER and PLASTIC POWER and CONTROL CABLE



Every type for every use!



BARE, WEATHERPROOF, INSULATED WIRES and CABLES FOR EVERY ELECTRICAL PURPOSE

Besides offering the most complete line, General Cable makes top notch engineering service and useful product information easily available.

Rubber and Plastic Power and Control Cable is designed for power transmission, distribution and control...for duct and conduit installation...for direct earth burial...for submarine and aerial use (self supporting types are available).

Rubber or GENCORONE (corona resistant) oil base compound or plastic insulated...with braided, leaded, interlocked or submarine armored finish.

These popular and versatile lines of products are made to meet practically every operating condition. Get the full facts before you buy. Let our engineers help solve your wire and cable problems.

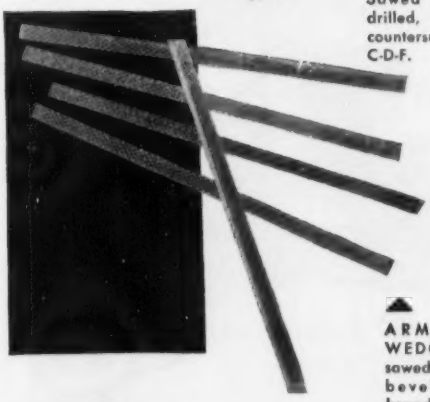
GENERAL CABLE CORPORATION

420 Lexington Avenue, New York 17, New York • Sales Offices: Atlanta • Buffalo Cambridge (Mass.) • Chicago • Cleveland • Dallas • Detroit • Greensboro (N. C.) • Houston Indianapolis • Kansas City • Los Angeles • Milwaukee • Minneapolis • New York • Newark (N. J.) • Philadelphia • Pittsburgh • Portland (Ore.) • Rome (N. Y.) • Rossmoyne (Ohio) (Cincinnati area) • St. Louis • San Francisco • Seattle • Syracuse • Tulsa • Washington, D. C.

GP-42A

For high heat applications C-D-F Melamine Dilecto cleanly machined by C-D-F

AIRCRAFT PANEL BOARD — GB-28M, ¼" laminate. Sawed to shape, holes drilled, counterbored and countersunk. Machined by C-D-F.



ARMATURE SLOT WEDGES — GB-28M, sawed into strips, then beveled edges were broached to angle of 21° 23', and strips were cut to exact length. Machined by C-D-F.

RF COIL FORM — Natural GB-112M Dilecto rolled tubing, smooth edged. Sawed to length; drilled and burred by C-D-F.

As operating temperatures rise, melamine laminated plastics can satisfy many requirements for component parts. Glass base melamine grades of Dilecto resist elevated temperatures —up to 300° F. continuously, 350° F. intermittently. They have extremely high impact strength; excellent arc resistance and self-extinguishing properties. C-D-F melamine Dilecto grades are usually specified for many electrical applications requiring high arc resistance, mechanical strength, flame and heat resistance.

C-D-F can supply melamine Dilecto in sheets, tubes and rods in the following grades:

GB-28M—Medium weight glass base laminate with melamine resin. Highest mechanical strength; excellent arc resistance, high heat and flame resistance; self-extinguishing. Dimensionally stable—little affected by temperature and humidity.

GB-112M—Lightweight glass fabric with melamine resin. Substantially same characteristics as GB-28M. Usually produced in thickness less than ⅛".

GM-1—Glass mat base melamine resin bonded laminate. A lower cost product suitable for many applications requiring arc resistance along with good mechanical strength and flame resistance.

USE COMPLETE MANUFACTURING FACILITIES OF C-D-F. Make us responsible for your complete job . . . from laminates to finish machining of components. C-D-F has the know-how to cleanly machine melamine Dilecto to close tolerances. C-D-F can save you time, money and waste of material. And when you make C-D-F responsible for the complete job, you know what you're getting: components machined to exact specifications; strict adherence to quoted prices; and prompt delivery.

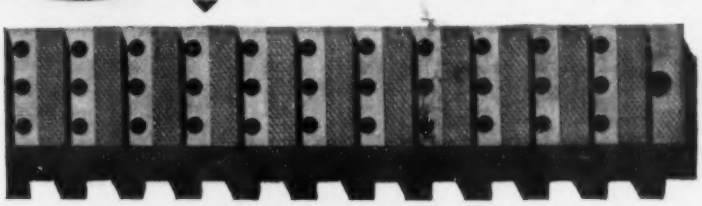
Write for samples and technical bulletins on melamine Dilecto components. Call in a C-D-F sales engineer, tell him your problem. He'll help you.

THE NAME TO REMEMBER CDF MELAMINE DILECTO

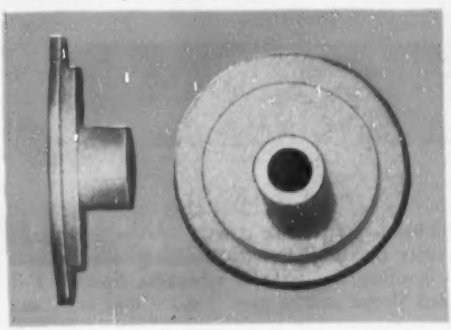
Continental-Diamond Fibre Company

NEWARK 15, DELAWARE

TERMINAL BLOCK—GB-28M. Sawed to shape, grooves milled, corners sanded round. Holes were drilled, counterbored, characters stamped. Machined by C-D-F.



INSULATOR — ML rod. Turned on automatic screw machine by C-D-F. Grade ML is a fine weave cotton fabric base laminate bonded with a melamine resin. Easy to machine.



"Here's why I buy my CABLE ACCESSORIES where I buy my cable—at ANACONDA!

"It simplifies ordering. It concentrates responsibility. It speeds up shipments.

"And it assures me of cable accessories that are designed, engineered, made and tested by power-cable specialists."

Yes, it will pay you to check your needs against Anaconda's complete line, including:

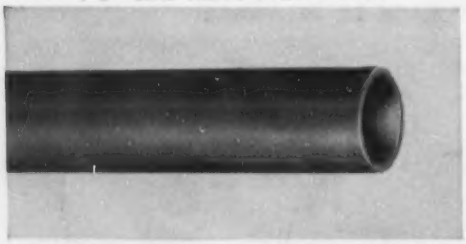
POTHEADS

Parts are *fully interchangeable* for greater adaptability, faster delivery, easier installation and lower costs. Anaconda supplies both gasket and solder-sealed types . . . your stock problem is simplified, too!

JOINTING KIT

Your cable-installation crews have everything they need for a specific joint. All the materials you need are always on the spot—never forgotten . . . never left behind—assures neat, lasting job.

F-3* LEAD-ALLOY JOINT SLEEVE



F-3 has higher tensile strength, lower creep rate, greater bursting strength, and higher resistance to bending fatigue and vibration. Specify F-3 Lead Sleeve and be sure. *Reg. U. S. Pat. Off. 54347

Write for free Cable Accessories Catalog to *Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.*

ANACONDA®

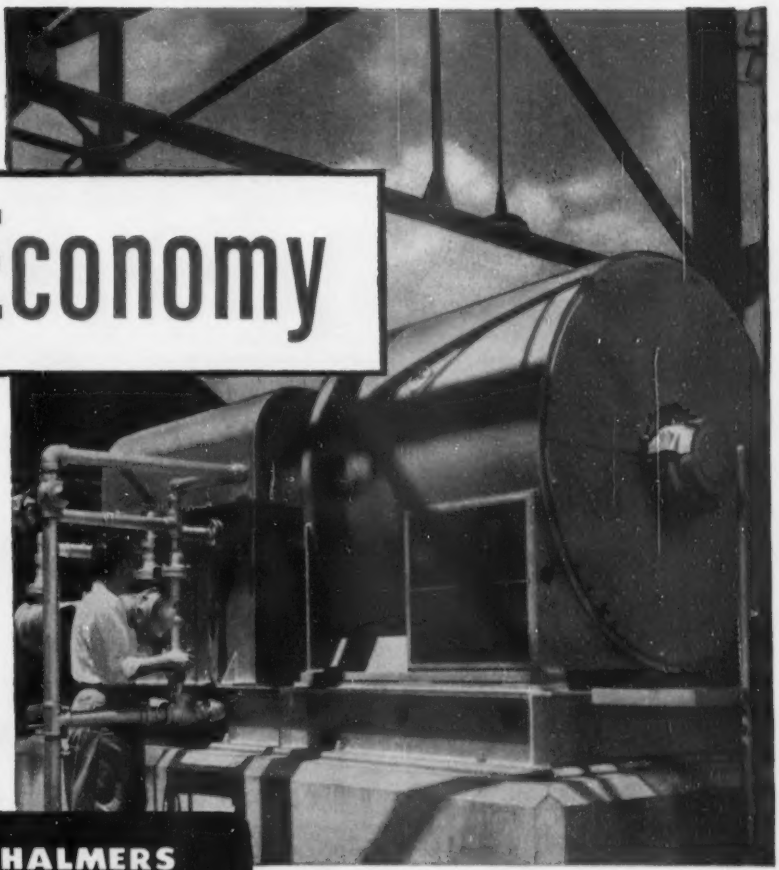
where cable accessories are made by cable experts

3-Way Economy

OPEN SKY is all the roof they need

MAINTENANCE is cut to the minimum

RELIABILITY assures maximum availability



ALLIS-CHALMERS
Tube-Type
TEFC MOTORS

Induced-draft fan motor for A-C turbine-generator equipped installation at Georgia Power's Plant McManus is rated 900 hp, 2300 volts, 705 rpm.

WITH Allis-Chalmers *tube-type* totally-enclosed fan-cooled motors, you can cut auxiliary drive costs three ways. The opportunity for low installation cost through outdoor applications is only the beginning. Low maintenance and peak reliability both pay worth-while dividends throughout the long life of these motors.

These savings can be yours because the *tube-type* air-to-air heat exchanger design of Allis-Chalmers TEFC motors offers these advantages:

Complete enclosure protects stator core and other electrical parts from dirt and corrosion — indoors or out — under the most severe ambient conditions.

Self-cleaning action results from generous flow of outside air through smooth, straight, heat-exchanger cooling tubes.

Full internal air circulation provides efficient, even cooling for long, trouble-free insulation life . . . and makes large ratings practical.

Available in sizes from 40 hp at 600 rpm to the largest required for power plant auxiliaries, this motor design has been proved in operation by hundreds of installations since 1946. For more information ask your A-C representative for Bulletins 51B7149 and 05B7150, or write to Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4258

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Roeplastic control cable—

THE ONLY CONTROL CABLE WITH CIRCUITS

POSITIVELY

IDENTIFIED

THIS NEW Roebling ROEPLASTIC Control Cable makes circuit identification quick and certain for the first time in history. A workman can't go wrong even if he's color blind. Here's why:

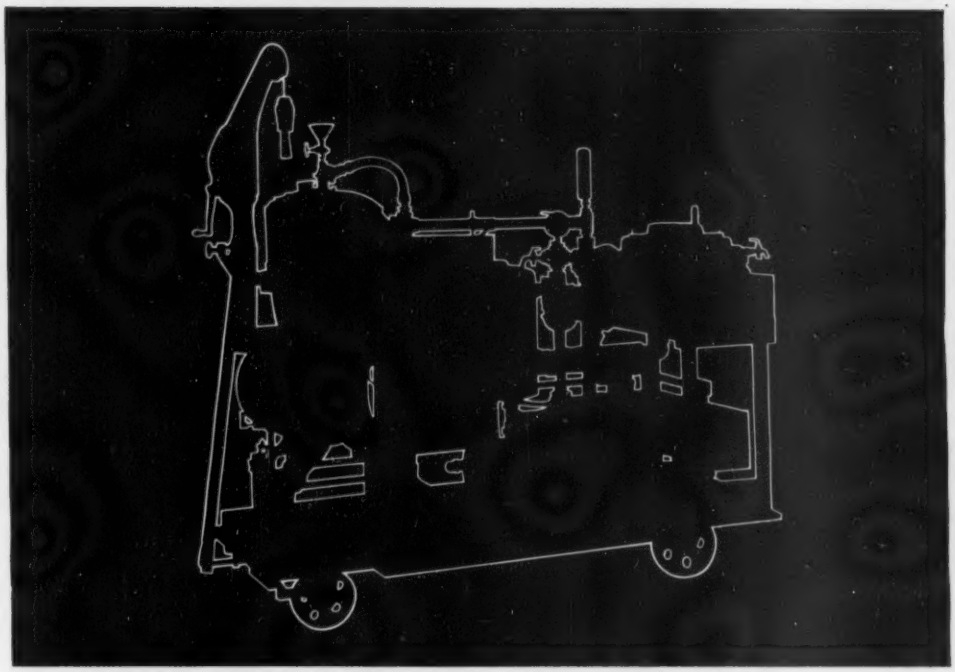
In ROEPLASTIC Control Cable, each conductor is identified from end to end by both its IPCEA code color name and its individual number by means of an indelible printing against a strongly contrasting background. The printing is permanent; it cannot fade or rub off... identification is always positive whether plans show circuits by color code or by numerals.

Roebling ROEPLASTIC Control and Signal Cables are ideal for such purposes as remote control of motors, switch gear, automatic machinery, etc.... for traffic light control, relay, metering and supervisory circuits. They are made in constructions, types of insulations and over-all sheaths to meet every specific requirement. Write for technical data... and order ROEPLASTIC Control and Signal Cables from your Roebling distributor. John A. Roebling's Sons Corporation, Trenton 2, N. J.

Subsidiary of The Colorado Fuel and Iron Corporation

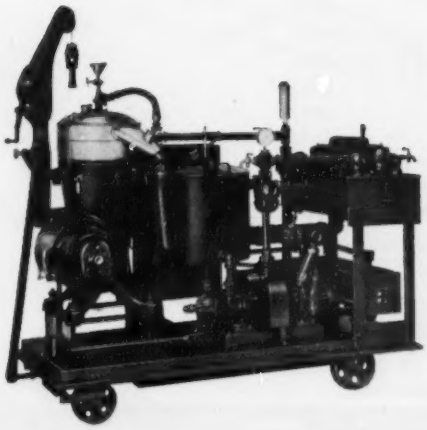
ROEBLING

ATLANTA, 934 AVON AVE • BOSTON, 51 SLEEPER ST & 9 PITTSBURGH ST • CHICAGO, 5525 W. ROOSEVELT RD • CINCINNATI, 3253 FREBONIA AVE • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG • HOUSTON, 5216 NAVIGATION BLVD • LOS ANGELES, 5340 E. HARBOR ST • NEW YORK, 19 RECTOR ST • ODESSA, TEXAS, 1920 E. 2ND ST • PHILADELPHIA, 230 VINE ST • ROCHESTER, 1 FLINT ST • SAN FRANCISCO, 1740 17TH ST • SEATTLE, 900 1ST AVE S. • ST. LOUIS, 3001 DELMAR BLVD • TULSA, 32 N. CHEYENNE ST • EXPORT SALES OFFICE, TRENTON 2, NEW JERSEY



OUTLINE FOR FOOLPROOF INSULATING OIL PURIFICATION

A De Laval Insulating Oil Purifier provides the most simple . . . safe . . . and reliable method of maintaining the dielectric of your transformer and circuit breaker oil. In the bowl of the De Laval centrifuge, water is ***continuously*** removed, and immediately discharged to waste.



The De Laval Insulating Oil Purifier always operates at constant efficiency. It cannot suddenly lose its effectiveness. There is no danger that a batch of oil in the process of purification will go in an instant from a high to a low dielectric test.

Other advantages of De Laval centrifugal Insulating Oil Purification include low operating cost, low temperature purification and high daily capacity.

THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

DE LAVAL INSULATING OIL PURIFIERS

"Thank You, Mr. Mullen"

An inquiry came across our desk recently for the names of distributors of Manson tape in Minneapolis. What snared our attention was the closing line in the note, "This is the 'best tape' that we have ever used, and we would like to obtain more." The writer, Mr. W. H. Mullen of the Bernard L. Dalsin Company of Minneapolis,

you can be assured, was answered promptly.

The Dalsin Company is not a big user of tape, they required only several rolls—but they did like it and took pains to get a new supply. This, we are certain, is the best testimonial to a good product.

Tape users everywhere have found that Manson tape is definitely a superior product. It is unequalled in true adhesiveness, and will retain this quality over extremely long periods. It is a true friction tape made of a closely woven cotton fabric into which has been frictioned only new, naturally tacky rubber compounded with the best chemical ingredients.

Okolite, Okoprene and Manson tapes make splices that will be tight and waterproof far longer than ordinary tapes, and consequently reduce maintenance costs. It's "spliced for life" when you use Okonite premium quality tapes.

Write for a set of instruction sheets EW 5678; they will help solve your splicing problems.

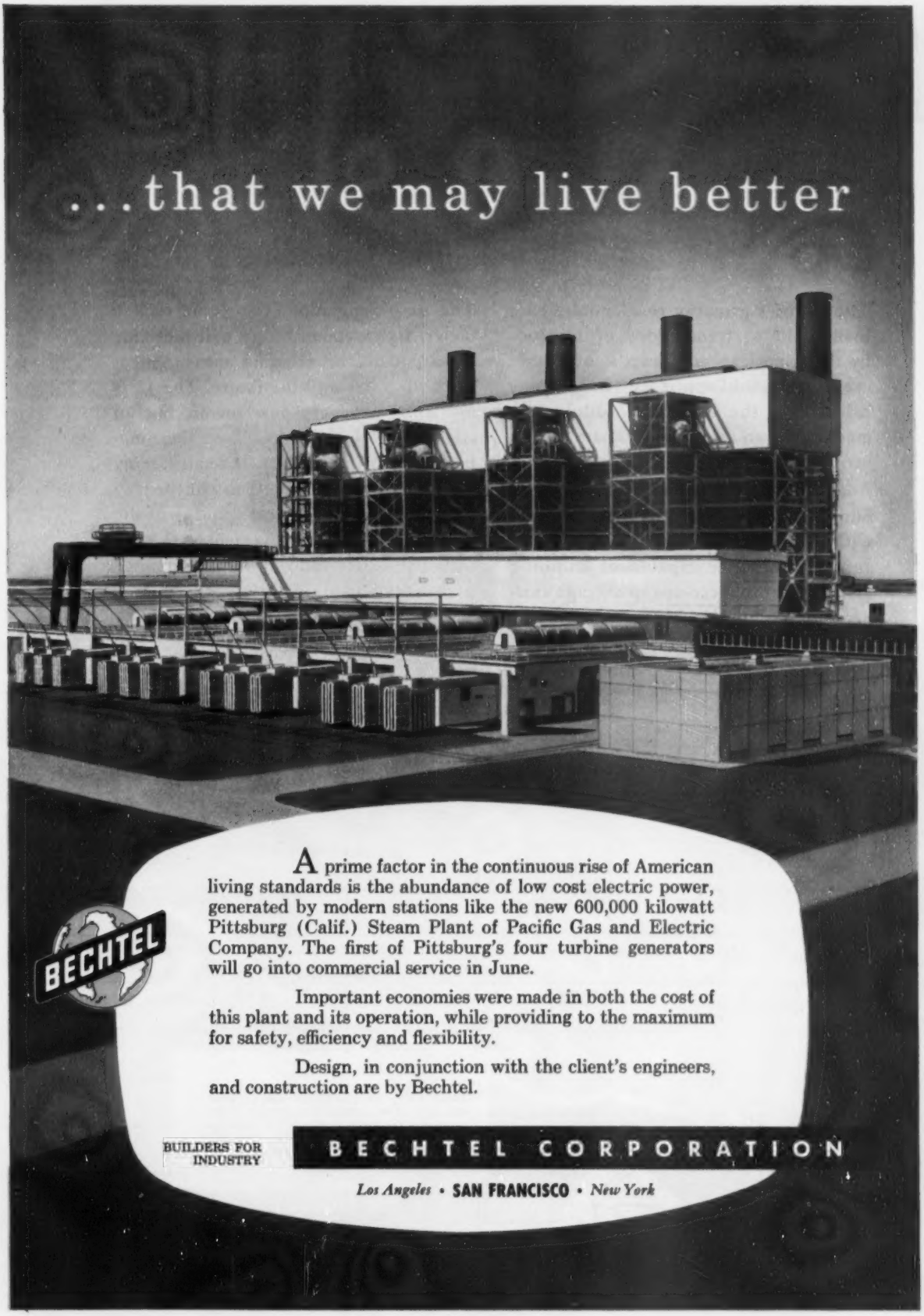
...when you splice with:

AVAILABLE THROUGH AUTHORIZED DISTRIBUTORS ONLY

2042

Made by
THE OKONITE COMPANY
PASSAIC NEW JERSEY
SINCE 1878

SPECIALISTS IN ELECTRICAL WIRES, CABLES AND SPLICING MATERIALS FOR 75 YEARS



A prime factor in the continuous rise of American living standards is the abundance of low cost electric power, generated by modern stations like the new 600,000 kilowatt Pittsburg (Calif.) Steam Plant of Pacific Gas and Electric Company. The first of Pittsburg's four turbine generators will go into commercial service in June.

Important economies were made in both the cost of this plant and its operation, while providing to the maximum for safety, efficiency and flexibility.

Design, in conjunction with the client's engineers, and construction are by Bechtel.

BECHTEL

BUILDERS FOR INDUSTRY

BECHTEL CORPORATION

Los Angeles • **SAN FRANCISCO** • *New York*

the NEW Sangamo Type J2

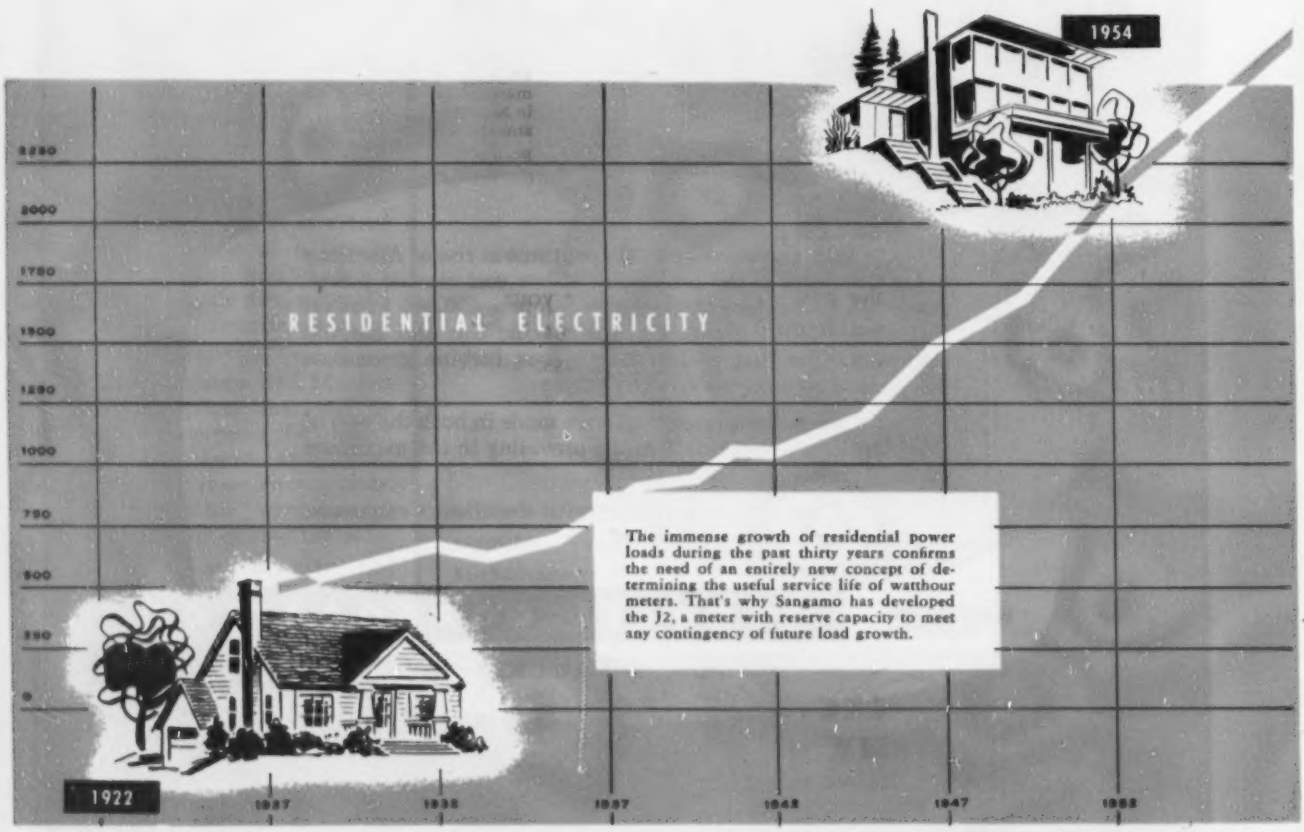
Extended Range Singlephase Watthour Meter

to measure the adequately wired loads of tomorrow

The nation's growing residential power load, built to tremendous proportions by the American consumer's increasing use of household appliances, has led to a crisis that the electrical industry is meeting by an effective adequate wiring program.

Adequate *measurement* of the loads of the future will require a watthour meter with straight line accuracy up to 100 amperes—a meter capable of handling all foreseeable increases in average residential consumption.

The new Sangamo Type J2 *is* such a meter. Its extended range will meet the requirements of accurate measurement for both today and the future. The J2 is not a *revolutionary* new meter, but an *evolutionary* development from the time-proven Sangamo Type J. It retains many features that contributed to the proven electrical and mechanical stability of the Type J. Added improvements all contribute to better and longer performance over an extended operating range.



The immense growth of residential power loads during the past thirty years confirms the need of an entirely new concept of determining the useful service life of watthour meters. That's why Sangamo has developed the J2, a meter with reserve capacity to meet any contingency of future load growth.

The new Sangamo J2 will protect your investment in new meters by providing sufficient reserve capacity to meet any contingency of future load growth—sustained accuracy with minimum maintenance during its entire life—at *no increase in cost or price.*

NOW...

with the Type J2, you get

- Accurate measurement to 100 amperes, without sacrifice of performance at light loads.
- Lower disk speed, but with same high torque as the time-proven Type J.
- Increased bearing life with improved bearing performance from a fraction of an ampere to 100 amperes.
- Higher resistance to repeated high voltage surges.
- Improved corrosion-resistant finishes and materials for better and longer performance in humid, salt-laden or corrosive industrial atmospheres.
- Plus all the features that have made Type J the Meterman's meter for fourteen years.

Sangamo presents the new J2 with full confidence that this singlephase watthour meter—the finest in Sangamo history—will prove a much needed advance in meter design.

Get the facts . . . mail the coupon below for your copy of "Protect your Investment in New Meters." It's just off the press, and gives the complete story of the evolution of the Sangamo Type J2 . . . the Meter with reserve capacity for growing loads.

SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

JM54-1

SANGAMO ELECTRIC COMPANY, SPRINGFIELD, ILLINOIS

Send my copy of "Protect Your Investment in New Meters"

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY and ZONE _____ STATE _____

Increase conductivity and protect your connections with BLACKBURN's *Contax*

Available in ½ lb. tubes and pint, quart and gallon cans.

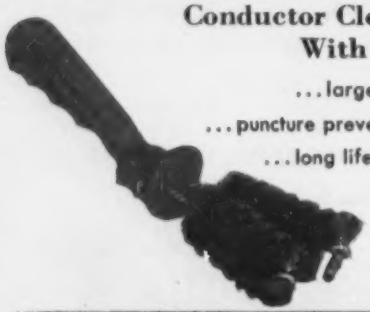
Metallic particles in Contax break through oxide films, lowering interstrand and joint resistance. Low resistance connections remain cooler, and last longer.

High temperature stability, ASTM drop point of 380° F, insures lasting performance under severe operating conditions.

Contax is weather-resistant and seals out air and moisture to eliminate corrosion.

Contax is stable—will hold metallic particles in suspension indefinitely.

Extra heavy duty lead tube will not crack with flexing.



Conductor Cleaning Brush With Glove Guard

...large easy-grip handle
...puncture preventing glove guard
...long life rotatable brushes
...high dielectric durable coating

For Best Long Life Performance:

Brush-Clean Conductors
Apply Contax

BLACKBURN *Contax* CONTACT PASTE

JASPER BLACKBURN CORPORATION
35 Madison Street • St. Louis 6, Mo. • Phone MAin 1-2821

the 1 source for all types of utility bodies and equipment!

Whatever your utility body needs may be . . . from a set of compartment sections for a pick-up truck to a line body capable of handling the largest construction job . . . there's a POWERS-American Body designed to meet your requirements.

Available for construction, maintenance, and service work in all phases of the public utility industry, POWERS-American Bodies are "job-engineered" to step up crew efficiency and lower operation costs. Their quality construction guarantees long life and trouble-free service.

Whether your needs be large or small, standard or special, you'll find it a real economy to call POWERS-American . . . the 1 source for all types of utility bodies and equipment.

Look at all the features you get in POWERS-American Bodies

"Job-engineered" design • Equalized load distribution • Extra large weathertight compartments • Triple-seal compartment doors • Recessed slam-action door catches, with cylinder locks keyed alike • Additional line body features include: low-positioned rubber goods compartment • Full-size compartments on street side • Derrick stowed without interference to cab door or loss of compartment space • Extra depth in all compartments • Horizontal compartments for long material.

"THE ACCEPTED STANDARD WITH UTILITIES EVERYWHERE"

POWERS American DIVISION

McCABE-POWERS AUTO BODY COMPANY
5900 NORTH BROADWAY • ST. LOUIS 15, MISSOURI
WESTERN OFFICE: 428 LATHAM SQ. BLDG., OAKLAND 12, CALIF.

let's lay it

on the line !

In almost every instance, aluminum conductor offers savings over copper. By one standard, the ASTM specs, aluminum conductors may look the same. By other standards, the electric light and power industry's own, Alcoa® Aluminum Conductor is a standout.

Here are the plus factors you get when you buy Alcoa Aluminum Conductor, and without paying a penny more!

1. Every run tested throughout every production phase for metallurgical, mechanical and electrical uniformity.

2. Consistently uniform manufacture and tight stranding.

3. Cable for every service requirement including designs for special applications.

4. The services of the largest and best qualified headquarters and field engineering staff in the industry.

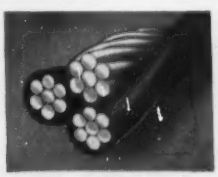
5. The latest developments and newest applications backed by Alcoa's unequaled 55 years of experience and leadership.

ALUMINUM COMPANY OF AMERICA
2100-D Alcoa Building • Pittsburgh 19, Pa.

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

ACSR and All-aluminum Wire and Cable


Covered Wire and Service Drop

Bus Conductors of All Types

Accessories for All Conductors

DUNCAN TYPE MH Polyphase Meters

A Polyphase Meter for Every Type of Service

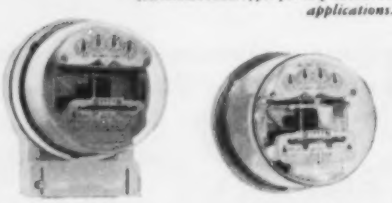
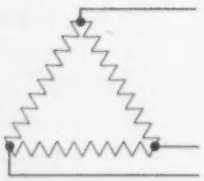
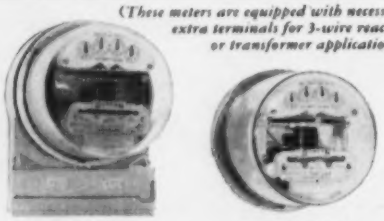
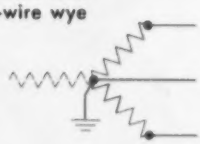
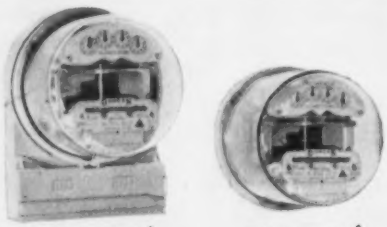
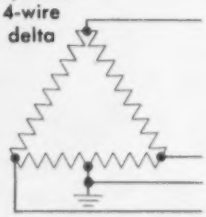
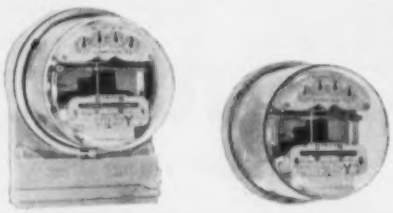
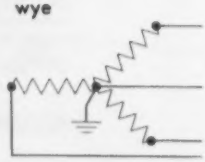
✓ ACCURACY ON HIGH OVERLOADS*

✓ SIMPLICITY

✓ GOOD PERFORMANCE

. . . as required for modern Polyphase Metering

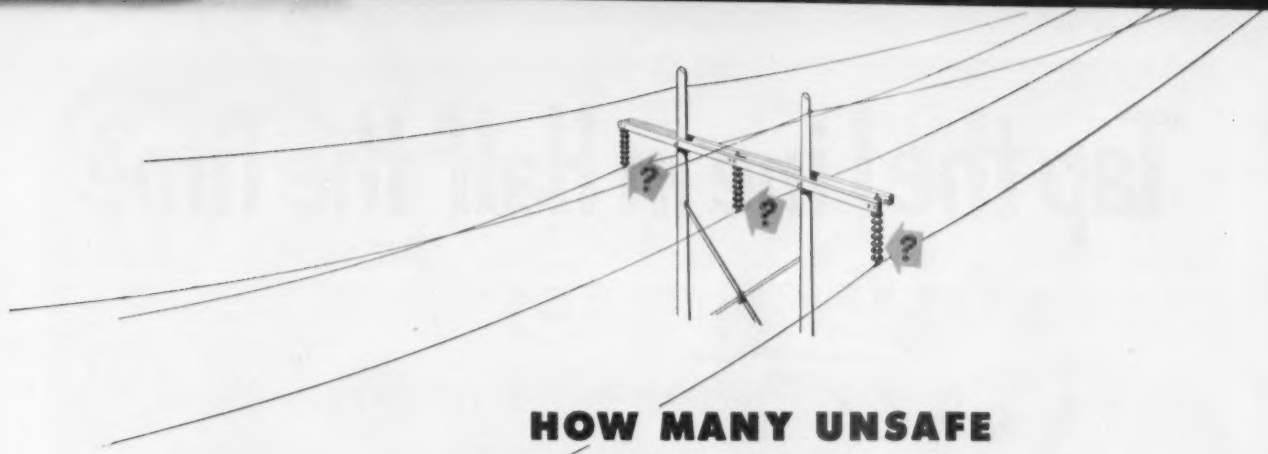
*All meters to 400% of nameplate rating, except 50 ampere bottom connected meters which go to 300%, or 150 amperes, due to the limitation of terminal block dimensions. The 50 ampere socket type meters may be used to meter continuous loads to 200 amperes in Duncan Type HD Mounting Device.

TYPE MH METERS	SERVICE
(Recommended types for self-contained applications.)	3-phase, 3-wire
 TYPE MH-2A TYPE MH-2S	
(These meters are equipped with necessary extra terminals for 3-wire reactive or transformer applications.)	3-wire from 4-wire wye
 TYPE MH-2P TYPE MH-2SP	
 TYPE MH-2P△ TYPE MH-2S△	3-phase, 4-wire delta 
 TYPE MH-2½P TYPE MH-2½S	3-phase, 4-wire wye 

Write for New Bulletin 179

DUNCAN
WATTHOUR METERS

DUNCAN ELECTRIC MFG. CO.
LAFAYETTE INDIANA

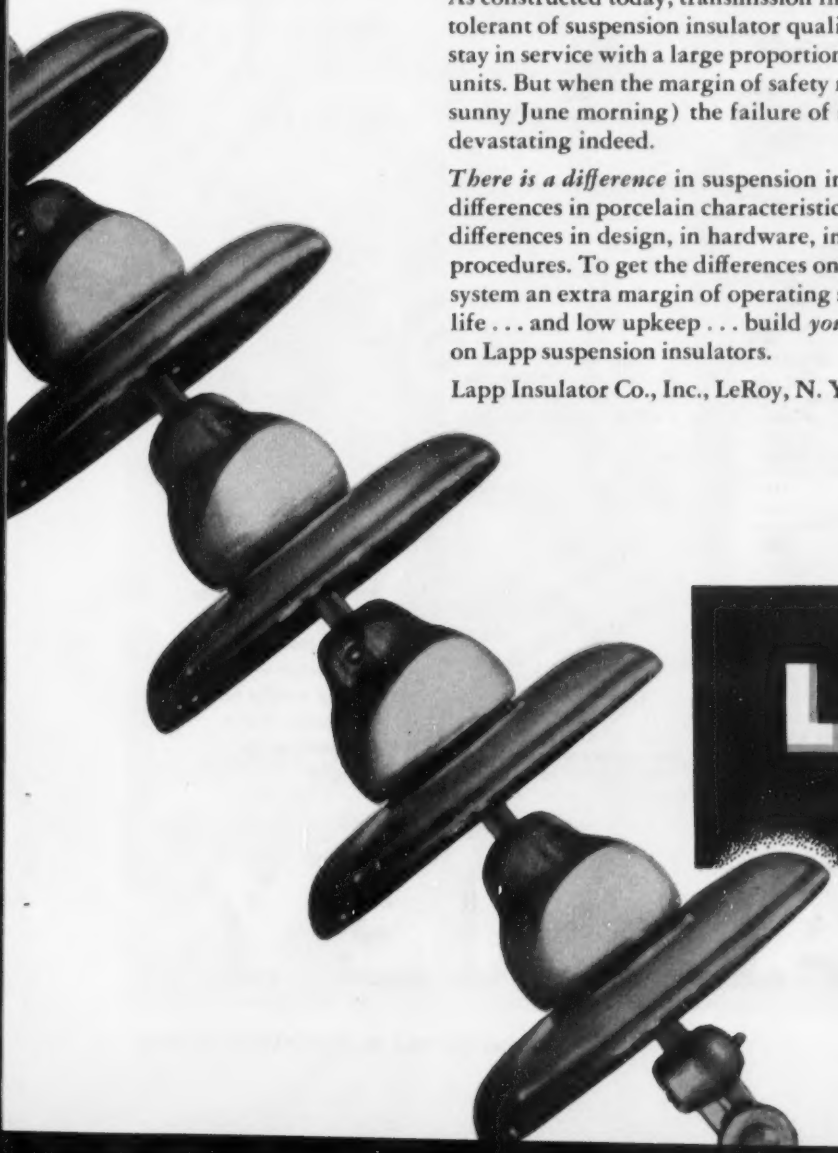


HOW MANY UNSAFE SUSPENSION INSULATORS ARE ON YOUR TRANSMISSION LINES?

As constructed today, transmission lines are pretty tolerant of suspension insulator quality. It is possible for a line to stay in service with a large proportion of sick, crippled or tired suspension units. But when the margin of safety runs out (and it won't be on a sunny June morning) the failure of such a "barely-in-service" line can be devastating indeed.

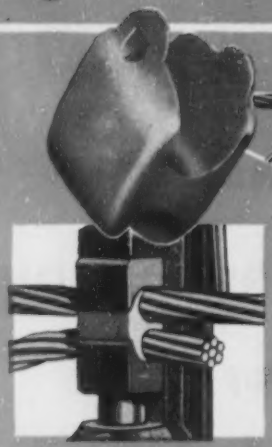
There is a difference in suspension insulator quality—which comes from differences in porcelain characteristics (electrical and mechanical), from differences in design, in hardware, in assembly techniques, in testing procedures. To get the differences on your side . . . to assure your system an extra margin of operating safety and security . . . long life . . . and low upkeep . . . build *your* transmission lines on Lapp suspension insulators.

Lapp Insulator Co., Inc., LeRoy, N. Y.



Lapp

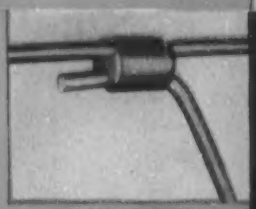
Tap the Line in Half the Time



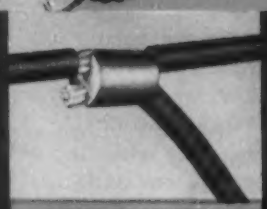
SEPARATE, FULL-CIRCUMFERENCE GRIP FOR EACH CABLE.

Only...

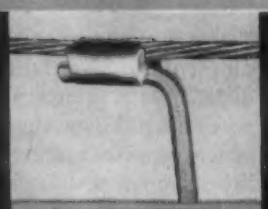
- **1 tool**
- **1 connector**
- **1 operation**



COPPER SQUEEZON
One operation of the Squeezon compression tool permanently bonds this type of joint.



ALUMINUM SQUEEZON
Aluminum connector for aluminum conductor provides large area contact—prevents cold flow, for aluminum to copper or copper to aluminum. No special connector necessary.



FOR T CONNECTIONS
Costly special connectors are eliminated by the use of Kearney Squeezon, for aluminum-to-copper connection.

TAP ON
Squeezon's weld-grip, high pressure bonding makes perfect aluminum-to-copper terminations.

DEAD-ENDS
One crimp per Squeezon saves time when multiple connectors are used.

STIRRUP TAP
Two Squeezons and a short piece of wire make an inexpensive, easy-to-install stirrup, insures a rigid, arc and corrosion-proof connection on hot lines.

LINE SPLICE
Line splices are better electrically and mechanically with Squeezon sleeves.

The Squeezon Tool with controlled hydraulic pressure cold welds the connector to the conductor — tool hangs easily to conductor fully supporting its weight.

Specify **KEARNEY**

SQUEEZON

"ONE-CRIMP" CONNECTORS

THE FAST, LOW-COST WAY TO MAKE OVERHEAD CONNECTIONS

One crimp...and you've got the connection!

That's all it takes when you make a line joint with a Squeezon and a Squeezon compression tool. You get a *better* connection . . . a perfect bonded, permanent joint. That's because Squeezon connectors provide *separate*, full-circumference grip on each cable, eliminates galvanic corrosion on transfer surfaces.

Squeezon economy and all-around utility will please you. Your line crews can handle any job in half the time and at a fraction of the cost of conventional methods. One Squeezon tool and two types of connectors . . . the aluminum and the solid copper . . . meet all line requirements.

QUICK-SERVE BIN BOX *(Patented)*
Squeezons are easily accessible in these handy boxes.

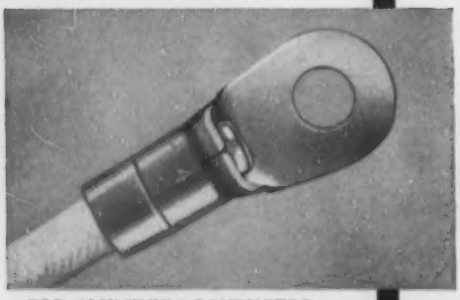
JAMES R. KEARNEY CORPORATION
4224-42 Clayton Avenue, St. Louis 10, Missouri
Canadian Plant: Guelph, Ontario

JAMES R. KEARNEY
CORPORATION
ST. LOUIS, MO.
GUELPH, ONT.

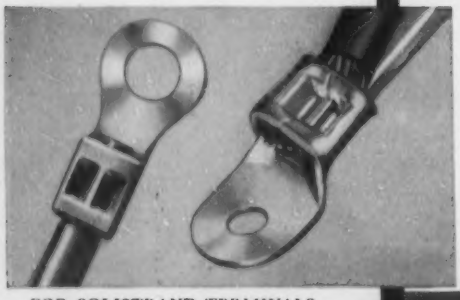
Products

For Better Construction— For Safer Maintenance

FOR AMPLI-BOND TERMINALS
A-MP's bonded insulation, Confined "C" Crimp, and insulation support features make precision-engineered AMPLI-BOND terminals the best quality insulated termination for copper wire. Special crimping head applies superior A-MP "C" Crimp for wire sizes 8 through 2.



FOR ALUMINUM CONDUCTOR TERMINATIONS
For applications where weight is the primary consideration, A-MP's novel cartridge type terminals, available in wire sizes 8 through 2, are applied with the same head as that used for AMPLI-BOND. These aluminum wire terminals offer, by way of insulation support, Confined "C" Crimp, and special inhibitor, a completely trouble-free termination.



FOR SOLISTRAND TERMINALS
The AMP W CRIMP for solid wire has two longitudinal indents which compress terminal and wire with a toggle action to produce a voidless, homogeneous mass within the crimp area. There is no finer crimp for solid, irregular shaped or combinations of these wire types.

Find out about the New AMP "CREATIVE APPROACH TO BETTER WIRING"

...An evaluation survey without cost or obligation.

NEW AMP LIGHTWEIGHT HAND HYDRAULIC TOOL

FEATURES:

- 6 TONS FORCE
- SWIVEL ACTION
- SPRING ACTUATED

More than one ton of force per pound of weight makes crimping even No. 2 terminals easier than ever before. Two styles of head are available, one for "W" Crimp, the other for "C" Crimp. The "W" Crimp is for solid and stranded wire and for uninsulated terminations. The "C" Crimp is for insulated terminations on stranded, copper wire and for uninsulated terminations of aluminum wire. Rotating nests or removable inserts give wide wire size range for each head.

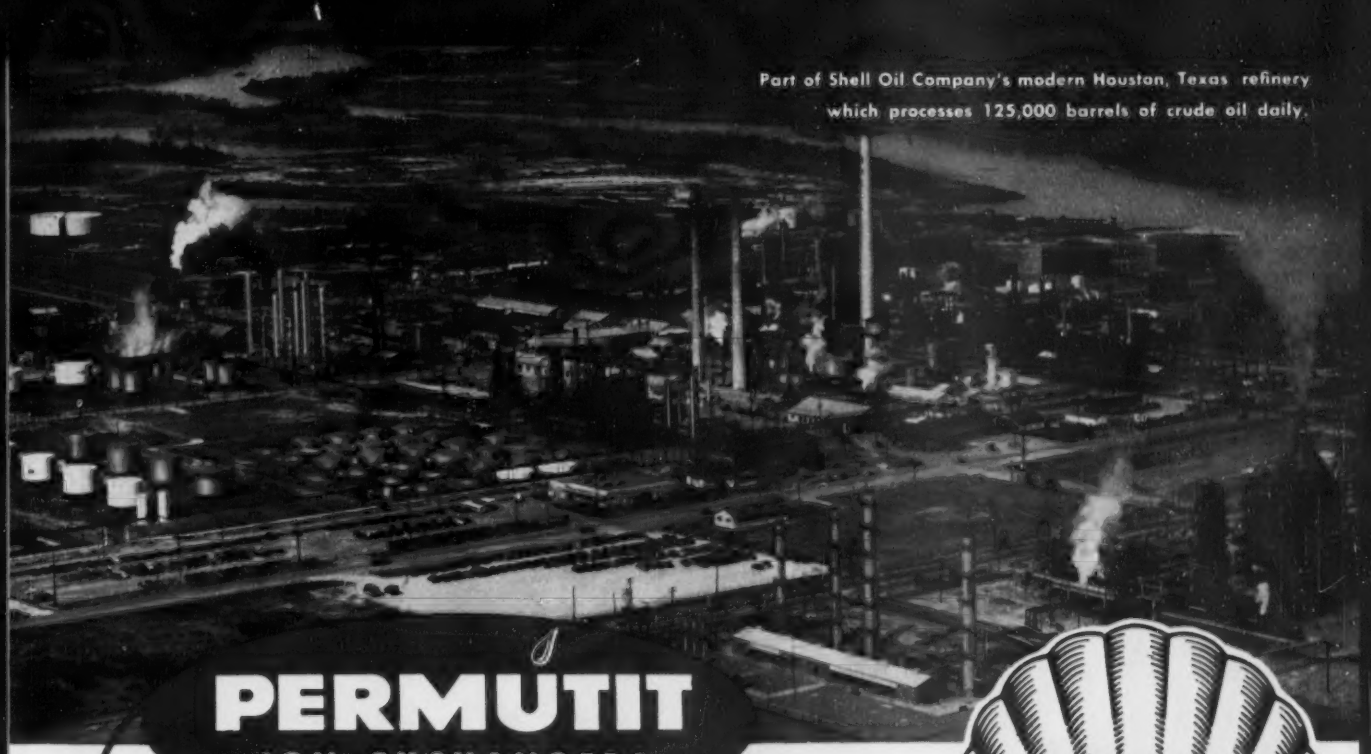
It's light! Weighs only 5 lbs. Double lever action of new tool reduces pumping time effort—takes 50% less strokes than conventional hand hydraulic tools. Sudden decrease in pressure indicates to the operator that the crimp is completed.

Literature on tool and terminals available upon request.

© AMP AMP Trade-Mark Reg. U.S. Pat. Off.

Aircraft-Marine Products, Inc.
2100 Paxton Street, Harrisburg, Pennsylvania

In Canada . . . . Aircraft-Marine Products of Canada, Ltd.
1764 Avenue Road, Toronto 12, Ontario, Canada

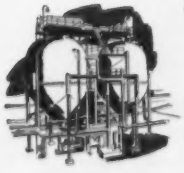


Part of Shell Oil Company's modern Houston, Texas refinery which processes 125,000 barrels of crude oil daily.

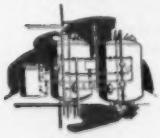
PERMUTIT
ION EXCHANGERS

deliver highest purity makeup for SHELL

BOILERS in this enormous Shell refinery operate at 650 psi. Steam output is received by turbo-generators . . . exhausted to process. ¶ To insure continuous steam turbine operation—for greater efficiency and more economical production—Permutit Demineralizing Equipment treats makeup water. The ion exchange units at right have a continuous capacity of 96,000 gph. ¶ The raw well water supply contains high total dissolved mineral solids—324 ppm, a harmful amount of silica—13 ppm. Its total hardness is 70 ppm, methyl orange alkalinity 230 ppm. ¶ This installation—a Permutit Two-Step Demineralizer with Degasifier—removes virtually all dissolved mineral solids. Silica is reduced to under 0.2 ppm. The effluent is purer than most distilled waters, costs much less to produce. Most important, costly shut-downs from heavy scale on turbine blades are prevented. ¶ Permutit makes all types of ion exchangers and water conditioning equipment . . . can save you time and money in the specification of the one combination that best suits your needs. ¶ For aid in solving your own water problems, write to The Permutit Company, Dept. EW-4 330 West 42nd St., New York 36, N. Y. or Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal.



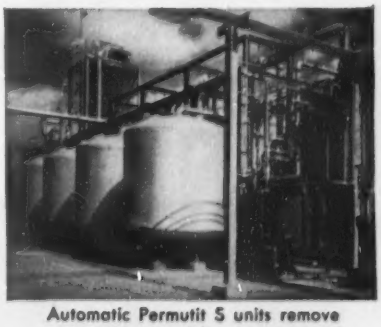
Sludge Blanket Hot Lime Soda



Hot Zeolite-Permutit Q

Deaerating Heater

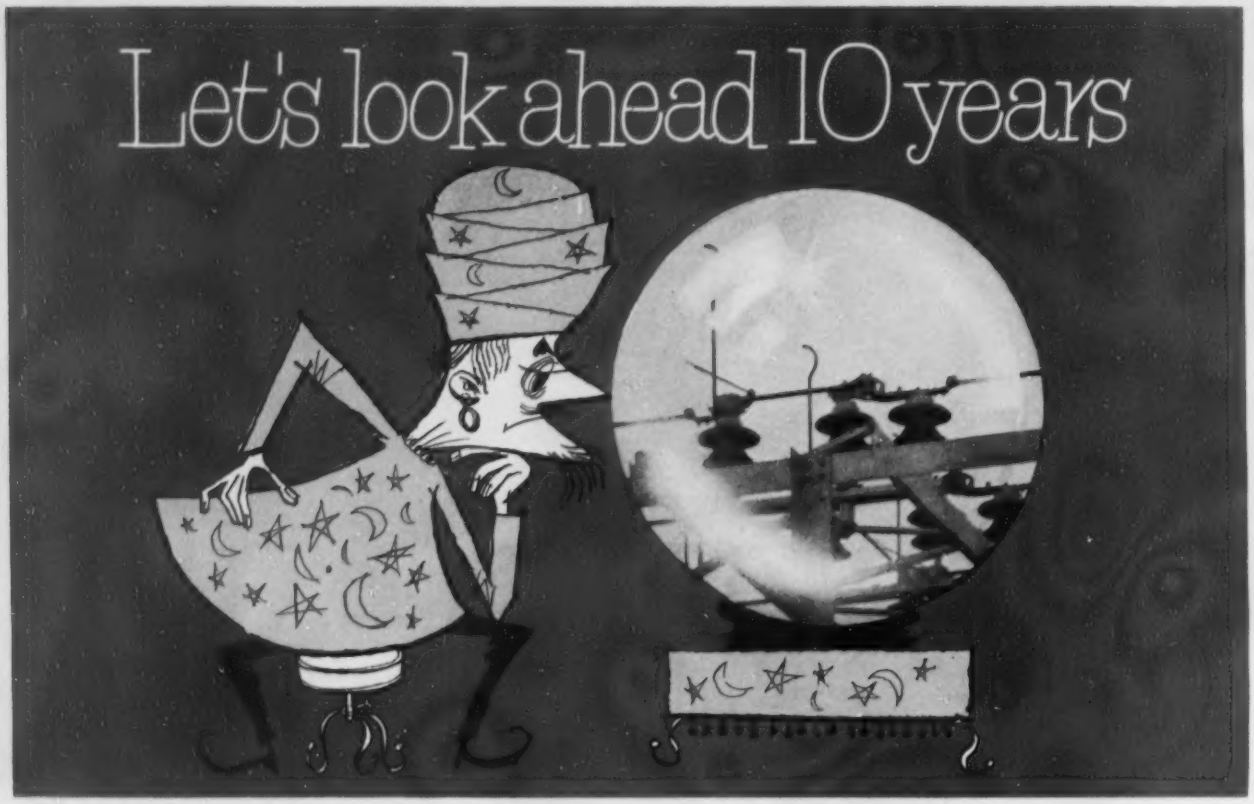
Automatic Permutit Zeo-Karb® units remove metallic cations from Shell's well water supply. Effluent passes to Degasifier at right for low cost CO_2 reduction.



Automatic Permutit S units remove remaining troublesome mineral impurities by anion exchange.

PERMUTIT®

ION EXCHANGE AND WATER CONDITIONING HEADQUARTERS FOR OVER 40 YEARS



Will the Hi-Voltage Switches that you install in 1954 withstand the short-circuit currents of 1964? The answer is definitely "yes". We cannot anticipate a short-circuit current great enough to "UNLOCK" a Hi-Voltage Switch.

WHY? There are two main reasons

1—Note in Figure 1 on the opposite page how short Dimension A is. If the leads to and from the switch were exactly in line with the switch blade, there would be no tendency for the blade to open under short circuit currents. However, for mechanical reasons, there must be a Dimension A, and if this dimension is increased, the force tending to open the switch increases. *Therefore, Hi-Voltage keeps Dimension A as small as possible.* This is of particular importance when you consider that as the magnitude of a short-circuit current grows, its opening force increases as the square of the current. Doubling the current will produce four times the force, and so on.

2—The second main reason why a short-circuit current cannot "unlock" a Hi-Voltage Switch is the exclusive "IN-OUT-UP" action illustrated on the opposite page. Because of this action, the blade moves laterally into the sleet hood. The contacts are *positively* locked at the tip end. Of course, Hi-Voltage also employs the customary method of blocking the linkage at the hinge end.

When Hi-Voltage Switches are closed, they stay "locked" until *you* want to open them.

HI-VOLTAGE

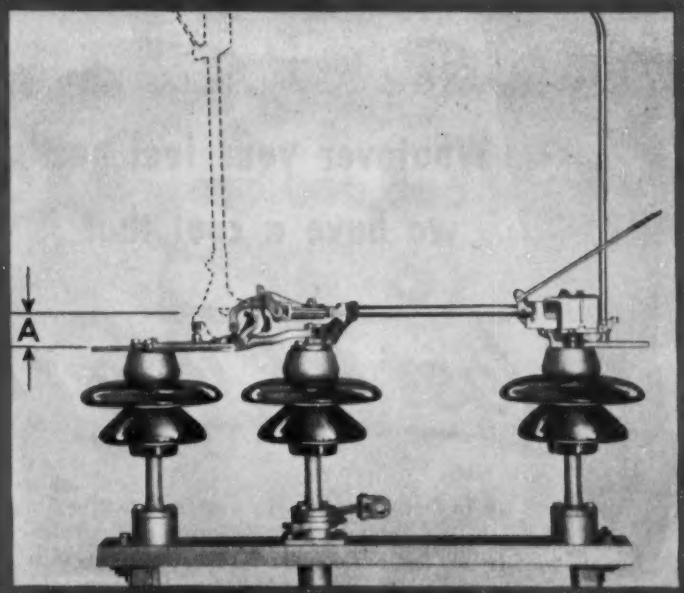


Fig. 1—Dimension A is made as small as possible to minimize the hammering and heaving of short-circuit currents on contacts, blades and terminals.

Figure 2—Looking at blocking only the linkage of a switch seems somewhat like pulling a lock on the hinge side of a door.

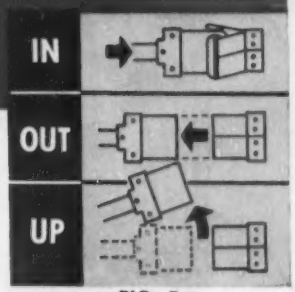


FIG. 5

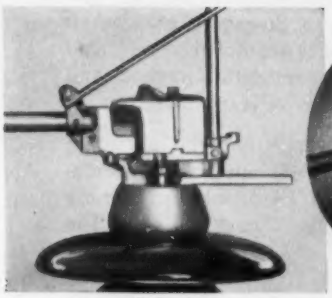


FIG. 3

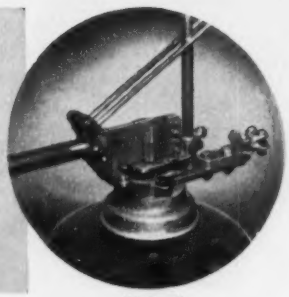


FIG. 4

OPERATING PRINCIPLE OF EXCLUSIVE "IN-OUT-UP" ACTION
(FIGURES 3, 4, 5)

When closing, switch blade *pushes* directly and horizontally into the silver-inlay contacts. When opening, switch blade *pulls* directly and horizontally from the silver-inlay contacts. Then, the switch blade is automatically lifted to the vertical position by the powerful operating mechanism. *There is no twisting or turning.* In Fig. 4, the steel hood has been removed to show the contacts.

The EXCLUSIVE "IN-OUT-UP" action is just one of the many outstanding features of Hi-Voltage Switches. Ask your Joslyn Representative about:

SILVER positive-pressure contacts.
MONEL BALL BEARINGS that never require any lubrication.
DIRECT MECHANICAL operating mechanism.
LOWEST POSSIBLE installation costs.

HI-VOLTAGE EQUIPMENT COMPANY
4000 EAST 116TH STREET • CLEVELAND 5, OHIO

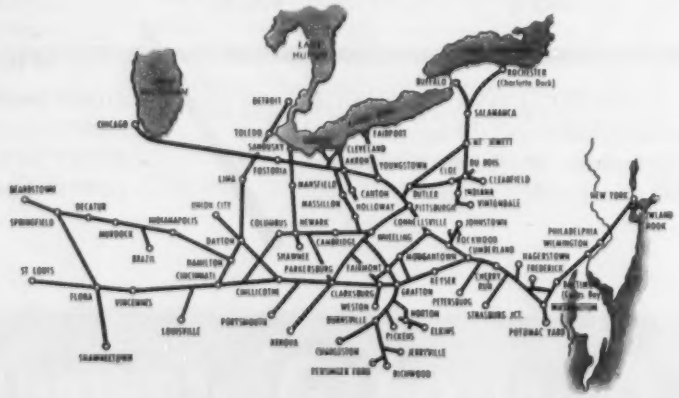
Whatever your fuel needs, we have a coal that is

Just the Ticket!

● In fact, you can write *your own* ticket—for the vast Bituminous fields served by the Baltimore & Ohio contain excellent coals *in wide variety*. For centuries to come, these coals will be available—a dependable source of low-cost heat and energy.

Modern mechanization at the mines assures low costs as well as uniform size and quality. The location of the fields—close to industry's front door—contributes to low transportation expense. Storage is economical because costly facilities are not required. And with the help of new combustion methods and equipment, Bituminous offers its users an increased burning potential.

ASK OUR MAN! He can give you worthwhile advice as to supply sources and burning methods for the particular coal you need. The efficiency, economy, and cleanliness of B&O Bituminous today will be a revelation!

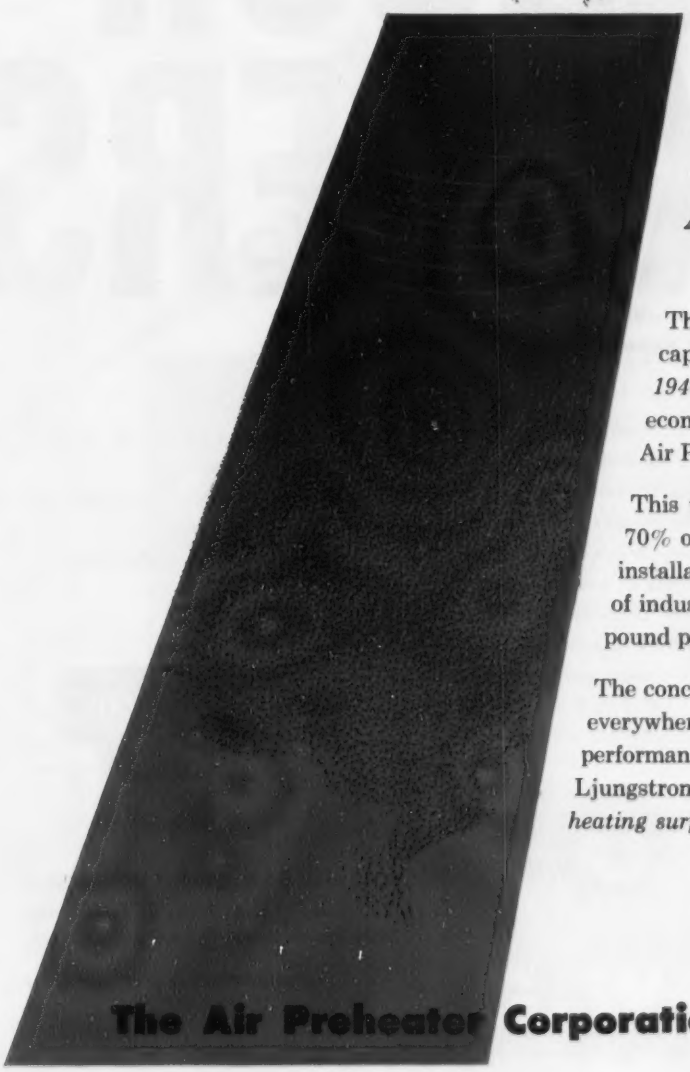


BITUMINOUS COALS FOR EVERY PURPOSE

BALTIMORE & OHIO RAILROAD

Constantly *doing things*—better!

420,000,000 pounds of steam per hour



served by

LJUNGSTROM

Air Preheaters

That's the amount of new steam capacity, installed or on order *since 1946 alone*, designed to utilize the economies available with the Ljungstrom Air Preheater.

This total capacity includes nearly 70% of all new central station boiler installations, as well as the major portion of industrial boilers in the over-250,000 pound per hour range.

The conclusion is obvious: Boiler users everywhere realize that the fuel-saving, performance-boosting abilities of the Ljungstrom make it the *most economical heating surface on the modern boiler.*

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

PRESENTS A SPECTACULAR ADVANCE

Thompson

IN

RIGHT-OF-WAY BRUSH CLEARANCE

BROAD SPECTRUM BRUSH KILLERS

Fortified with patented H. S. 31 to deliver extra creep for extra kill.

Thompson Broad Spectrum 2,4-D—2,4,5-T brush killers set a new standard for ease of application, more effective killing action and more economical results in brush clearance. Now your crews need no special technical skills—they simply mix and spray. Hard woods—all species—brush or weedy growth—powerful broad spectrum Thompson brush killers of controlled volatility remove the hazard of "chancey" effectiveness. Foliage spray or basal bark application, you get more kill per gallon and more gallons for your dollars.

Thompson Chemicals

Latest technical data free. Write for station paper No. 12

Thompson **CHEMICALS CORPORATION**

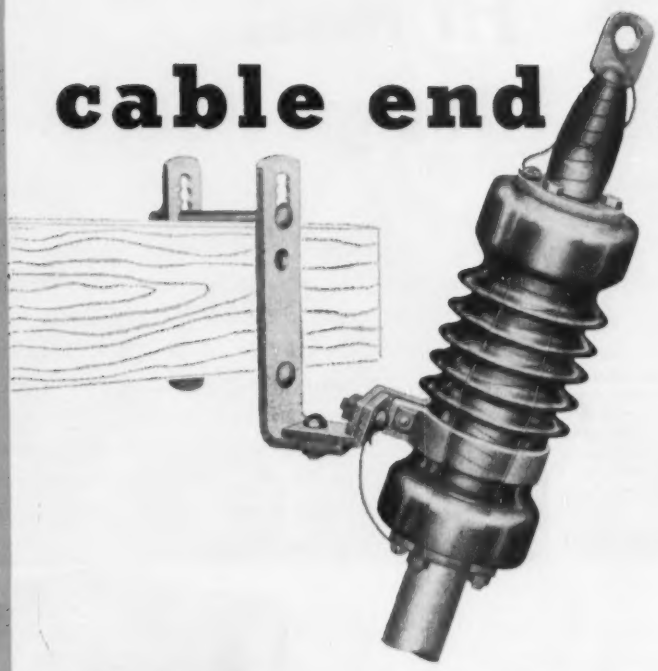
3028 Locust Street, St. Louis 3, Mo.
3600 Monon Street, Los Angeles 27, Calif.

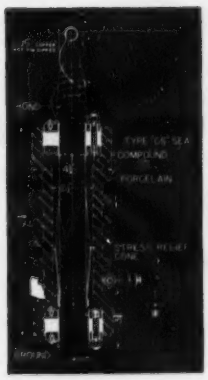
representatives in principal cities

FIRST NAME IN BRUSH KILLERS

a new approach to

cable end seals





Permanent, trouble-free protection for cable ends, against the contaminating effects of weather, is provided by this new G&W device.

These seals were specially designed for outdoor termination of single conductor, rubber insulated, shielded, Neoprene jacketed, 15,000 volt, 500 Mcm maximum cables. These end seals are porcelain insulated, compound filled and moisture sealed.

For further information and price write for Bulletin AD54, or ask your local G&W representative.

G & W ELECTRIC SPECIALTY CO.
7780 Dante Avenue, Chicago 19, Illinois
Representatives in principal cities of U.S.A. In Canada—Powerlite Devices, Ltd.

A 542

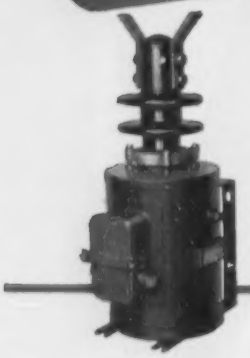
400 RATINGS

Fit Most Design Needs

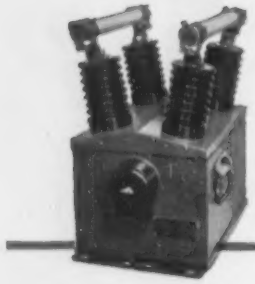
ALLIS-CHALMERS
INSTRUMENT TRANSFORMERS

VIRTUALLY *every* instrument transformer requirement can be met from Allis-Chalmers 400 ratings of current or potential transformers or metering outfits. You can select dry-type, oil- or compound-filled units, depending on transformer rating, application, and location outdoors or indoors.

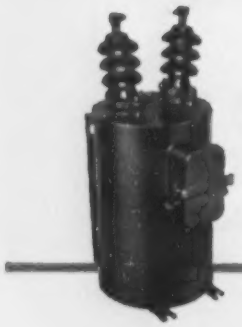
Every unit has the best combination of engineering and materials that 50 years of experience can provide. For top quality, wide selection, and quick delivery, it pays to specify Allis-Chalmers.



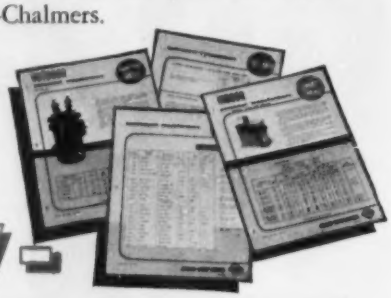
All Allis-Chalmers instrument transformers are designed to meet ASA standards. At left: Outdoor current transformer, Type KO, rated up to 15 kv, 800 amp.



Thousands of these units are now in use with excellent operating records. At left: Indoor potential transformer, Type PD, fused or unfused, rated up to 14,400 volts.



All transformers are liberally designed for long service — built for easy mounting. At left: Outdoor potential transformer, Type PWD, rated up to 14,400 volts.



NEW-

Dimension Sheets Give Complete Details

Just off the press: all the mechanical and electrical information you need in a convenient, complete bound set of data sheets. Gives more detailed presentation of Allis-Chalmers complete line of standard instrument transformers than ever before. For your copy, contact your nearby Allis-Chalmers district office or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4065

ALLIS-CHALMERS

Add invisible cops to your police force!

Light and lots of it is the very best deterrent there is to crimes of violence. That is why it is so terribly important that residential streets, as well as boulevards and shopping areas, be adequately and dependably lighted.

Dependable lighting has to be more than good looking, scientifically designed lighting fixtures. The power cables are part of it too. Such cables must be able to withstand winter thaws and freeze-up, as well as summer rains. They must also withstand high summer heat and winter cold.

ANHYDREX Series Street Lighting Cables do this and more. They can be buried in the ground or pulled through ducts. Sometimes they are used inside the lighting standard. But regardless of how they are used, they are dependable. They require no lead sheaths or metallic armor.

Want to know more about these versatile street lighting cables that can be used overhead or underground with or without ducts? Write us directly or contact our representative in your area for more detailed information.

Simplex–ANHYDREX
Series Street Lighting Cables

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Mass.

Complete Wood Transmission
Structures by JOSLYN

Fabrication of modern wood transmission structures requires the coordinated productive ability of four major industries: Galvanized pole line hardware ● wood poles and crossarms ● wood preservation by pressure treatment ● electrical porcelain and fittings.

All four industries are integrated within the Joslyn organization. Consequently, Joslyn holds a unique position as a supplier of wood transmission structures: We are proud to be the only manufacturer serving the electrical utility industry who can supply *with his own facilities* complete wood transmission line structures.

Joslyn pressure treating plant—Franklin Park, Illinois (Chicago).

Proper treatment of wood components in any transmission line is of vital importance. The extended service life obtained with *Joslyn incised pressure-treated* wood members not only insures against mechanical failure, but also coordinates life expectancy of the wood with other line components.

As prime producers of wood poles and crossarms, we are in a position to provide our customers with the best fir lumber available, specifically graded to fit the ultimate use.

Pinco electrical porcelain and hardware fittings are a recognized standard in the industry.

Combined with these comprehensive production facilities is a fund of transmission design engineering experience acquired over the past 20 years.

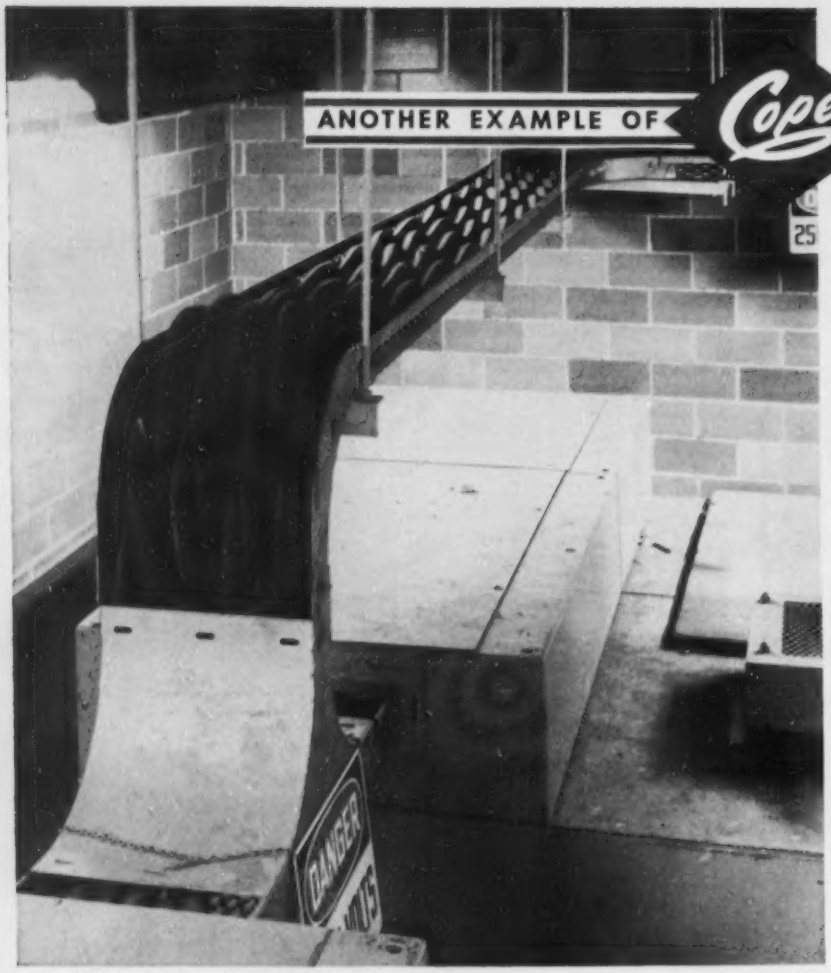
May we have the opportunity of quoting on your future requirements?

Joslyn transmission line hardware is produced in modern plants utilizing the latest type of equipment and production techniques.

Joslyn pole line hardware plant—Chicago, Illinois.

8-53

JOSLYN MFG. AND SUPPLY CO., 20 NORTH WACKER DRIVE, CHICAGO, ILL.



A SINGLE RUN OF COPE CABLE TROUGH CAN DO A MAN-SIZED JOB

The above photograph, taken in a section of the new Scott Paper Co. plant at Everett, Washington shows one run of Cope Cable Trough carrying four sets of three phase triplexed cable carrying 2300 volts properly spaced to give a free-air rating.

Because of its low cost and ease of installation, Cope Cable Trough is extremely popular as a standardized system for supporting power and control circuits in the industrial and utility field.

Cope Cable Trough is available in straight runs and a wide range of fittings (tees, elbows, drop-outs, etc.) which enables the entire system to be quickly and easily erected at the job site to conform to any layout.

Write today for further information. Ask for Bulletin 4W.

You know Cope by these products

Cope

T. J. COPE, INC.

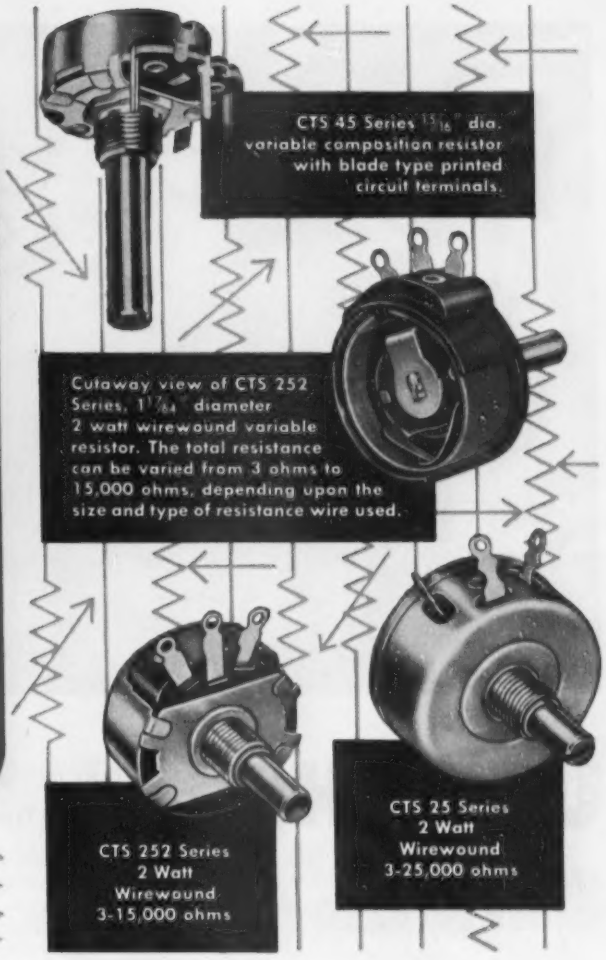
711 SOUTH 50th ST., PHILADELPHIA 43, PA.

"DRIVER-HARRIS ALLOYS

have contributed greatly in making our performance possible"

says

CHICAGO TELEPHONE SUPPLY *Corporation*


CTS 45 Series 13/16" dia. variable composition resistor with blade type printed circuit terminals.
Cutaway view of CTS 252 Series, 1 7/64" diameter 2 watt wirewound variable resistor. The total resistance can be varied from 3 ohms to 15,000 ohms, depending upon the size and type of resistance wire used.
CTS 252 Series 2 Watt Wirewound 3-15,000 ohms
CTS 25 Series 2 Watt Wirewound 3-25,000 ohms

Chicago Telephone Supply Corporation has succeeded in accomplishing two things indeed difficult to combine, as summed up in their slogan "Specialists in Precision Mass Production of Variable Resistors." They manufacture the high quality variable resistors indispensable to radio, television, and military electronics. In fact, they are the world's largest producers of variable resistors.

To achieve this outstanding record, they concentrate their entire effort on variable resistors, they maintain close control over all manufacturing processes, and fabricate their own parts under close supervision from basic raw materials. Naturally, they make no secret of the importance to them of high quality materials.

States Chicago Telephone: "To make our raw material program effective, we have stressed the importance of dependable, quality-minded sources of supply. Driver-Harris is a supplier with these qualities, *and Driver-Harris alloys have contributed greatly in making our performance possible.* For many years we have been using Driver-Harris Nichrome*, Karma*, Advance*, and other D-H Alloy wires for our resistance windings, with excellent results. We can strongly endorse Driver-Harris' dependability and high quality products."

Nichrome, Advance, and Karma are at your service too, as are more than 80 other D-H alloys developed for application in the electrical and electronic fields. If a high degree of resistance and absolute uniformity of output are "musts" for *your* product, let us have your specifications. We'll be glad to make recommendations based on your specific requirements.

*T.M. Reg. U.S. Pat. Off.

Sole producers of Nichrome, Advance, Karma

Driver-Harris Company

HARRISON, NEW JERSEY

BRANCHES: Chicago, Detroit, Cleveland, Louisville, Los Angeles, San Francisco

In Canada: The B. GREENING WIRE COMPANY, Ltd., Hamilton, Ontario.

MAKERS OF THE MOST COMPLETE LINE OF ELECTRIC HEATING, RESISTANCE, AND ELECTRONIC ALLOYS IN THE WORLD

THE JOB...

Strip Mining

USE THE CABLE THAT FITS THE JOB!

THE CABLE...

Hazacord Type SH-D Portable Cable

Ability to withstand extreme mechanical abuse and electrical stress is vital for long operational life in portable cables for shovels and drag lines. Hazacord Type SH-D Portable Cable combines the greatest electrical safety with maximum mechanical strength for long life and minimum outage in installations up to 15,000 volts.

Hazacord SH-D cables are protected by the mold-cured Hazaprene ZBF sheath with tire-tread toughness for extra mechanical strength. The copper shielding braid over each conductor, when properly grounded, equalizes electrical stresses and drains off all capacity-charging currents, insuring safety in handling. Grounding conductors in the interstices contact the copper shielding braid, providing an adequate low resistance ground for the equipment.

For information on this widely used design or on other portable cables, consult your Hazard representative or write Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

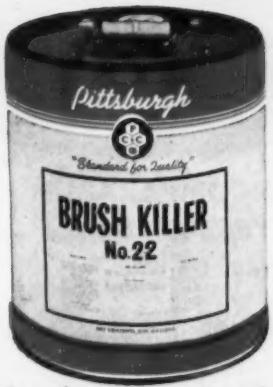
HAZARD

insulated cables

2137

FOR SAFER, LONGER-LASTING BRUSH CONTROL—

Pittsburgh BRUSH KILLER No. 22



Standard for Quality

CLEARING brush from power line rights-of-way by hand or machine-cutting methods is costly, time-consuming and only temporary, at best. But you can do the job right the first time —and do it easier, safer and far more economically when you spray with *Pittsburgh* Brush Killer No. 22. Here's why:

EASIER—*Pittsburgh* Brush Killer No. 22 greatly simplifies your rights-of-way clearance problem. One crew of few men can kill more brush in hours than a dozen men can kill in days by hand. And the brush is killed right down to the roots.

SAFER—*Pittsburgh* Brush Killer No. 22 contains the highly effective low volatile Isooctyl ester that minimizes vapor drifts and possible damage to nearby crops. And it does not affect grass growth.

MORE ECONOMICAL—With *Pittsburgh* Brush Killer No. 22, you can clear your rights-of-way at far less cost per mile than by hand or mechanical methods. And cleared rights-of-way enable your maintenance crews to cover more miles per day, with savings in labor and equipment. ● Write today for complete details on *Pittsburgh* Brush Killer No. 22.

AGRICULTURAL CHEMICALS DIVISION

PITTSBURGH COKE & CHEMICAL CO.

Grant Building • Pittsburgh 19, Pa.

W&D 8088

COAL CHEMICALS • AGRICULTURAL CHEMICALS • FINE CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

For You

PORCELAIN PRODUCTS
HIGH VOLTAGE DIVISION PLANT
PARKERSBURG, WEST VIRGINIA

Porcelain Products
New Improved Production Facilities
Transmission and Distribution Insulators and Fittings

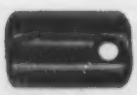
No. 66200–6"–10,000 lb. M & E—dated, performance tested distribution strain insulators. Quality controlled.

No. 6198N distribution pintype. Type "N" glaze eliminates radio and television interference developing at the insulator—available on all pintypes, new large wire grooves.

A RUGGED Work-horse ON *DEAD-ENDS*

INCOMPARABLE *TYPE "N" GLAZE*

Transmission and distribution fittings.



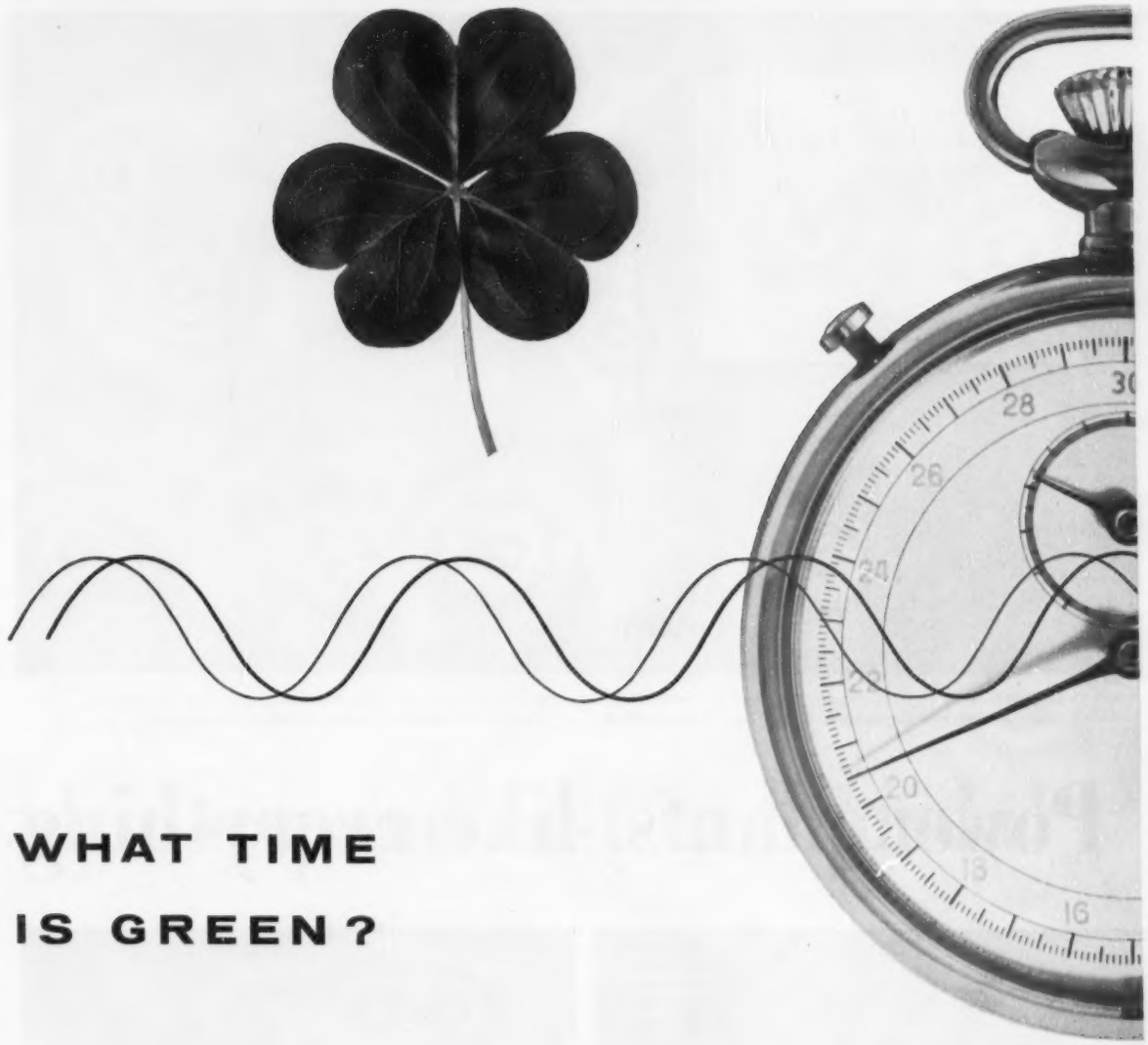
Guy Strain Insulators

Wet Process Spools

10" diameter suspension insulators.

PP INC.

Porcelain Products, Inc.
PARKERSBURG, W. VA.



WHAT TIME IS GREEN?

In color television, the colors on the screen are determined in a special way. A reference signal is sent and then the color signals are matched against it. For example, when the second signal is out of step by 50-billionths of a second, the color is green; 130-billionths means blue.

For colors to be true, the timing must be exact. An error of unbelievably small size can throw the entire picture off color. A delay of only a few billionths of a second can make a yellow dress appear green or a pale complexion look red.

To ready the Bell System's television network for color transmission, scientists at Bell Telephone Laboratories developed equipment which measures wave delay to one-billionth of a second. If the waves are off, as they wing their way across the country, they are corrected by equalizers placed at key points on the circuit.

This important contribution to color television is another example of the pioneer work done by Bell Telephone Laboratories to give America the finest communications in the world.

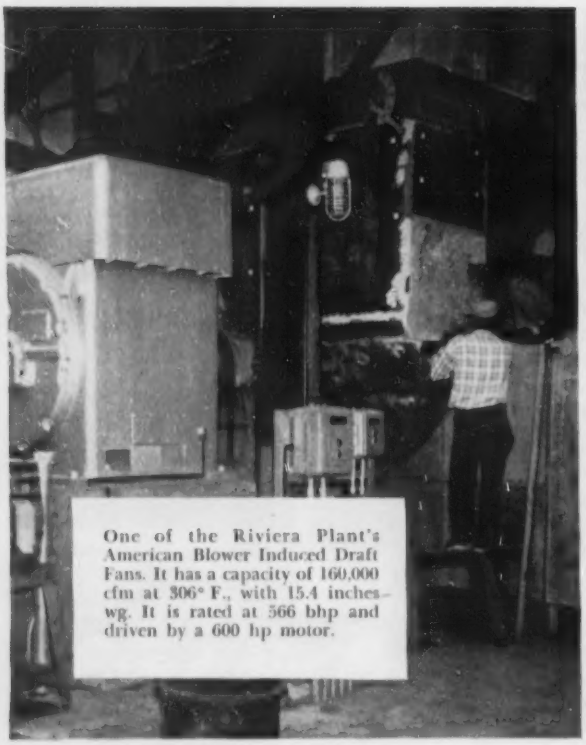
To keep colors true in television, signals must be kept on one of the world's strictest timetables. Equalizers that correct off-schedule waves are put into place at main repeater stations of the transcontinental radio-relay system.

BELL TELEPHONE LABORATORIES

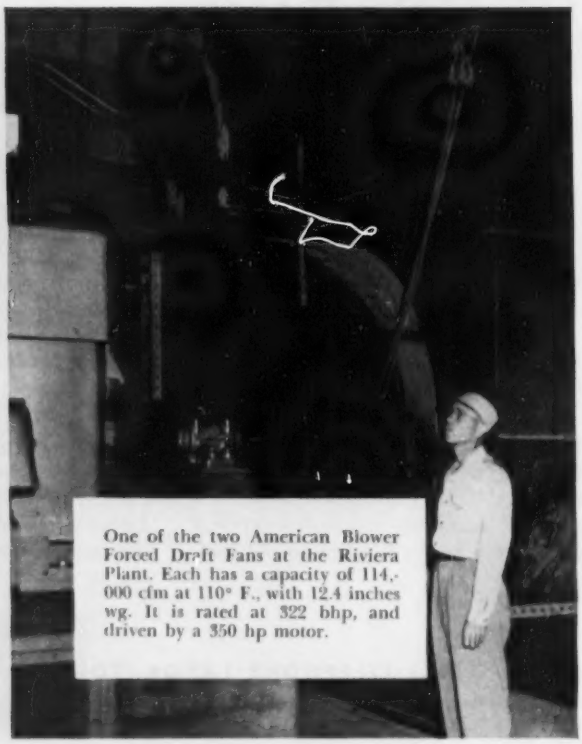
IMPROVING TELEPHONE SERVICE FOR AMERICA PROVIDES CAREERS FOR CREATIVE MEN IN SCIENTIFIC AND TECHNICAL FIELDS.

Florida Power & Light Company's beautiful Cutler Plant is the state's largest single generating plant. Its expansion to 240,000 kw. in 1954 will help the rapidly growing power needs of the thriving Greater Miami area.

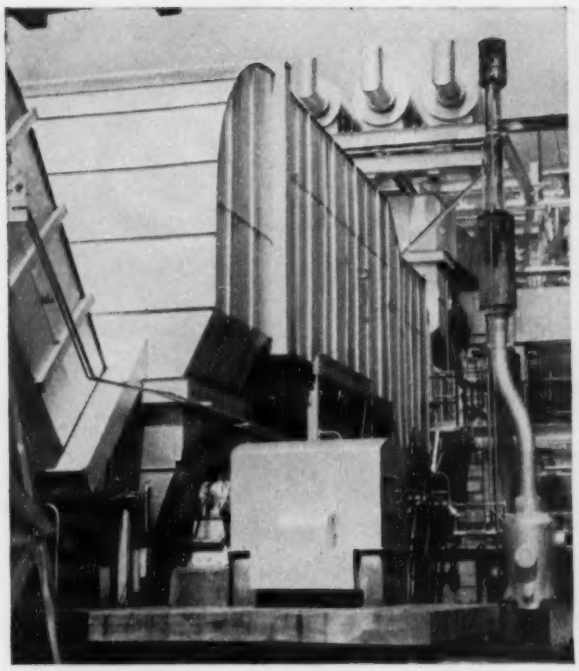
Power plants, like everything



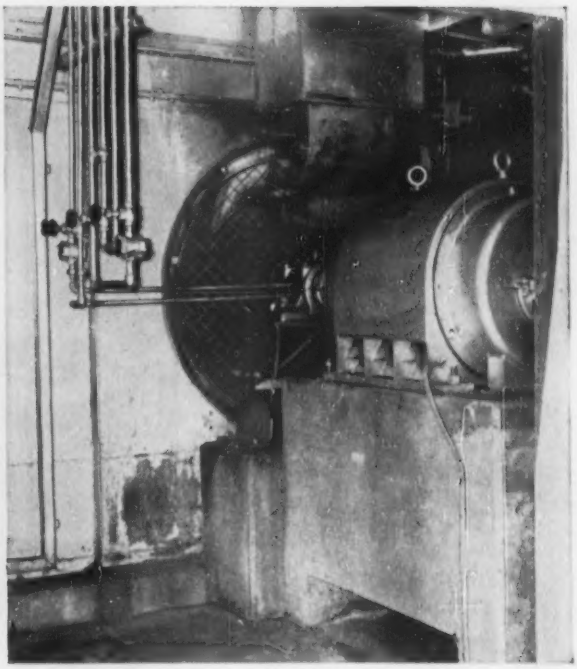
One of the Riviera Plant's American Blower Induced Draft Fans. It has a capacity of 160,000 cfm at 306° F., with 15.4 inches-wg. It is rated at 566 bhp and driven by a 600 hp motor.



One of the two American Blower Forced Draft Fans at the Riviera Plant. Each has a capacity of 114,000 cfm at 110° F., with 12.4 inches wg. It is rated at 322 bhp, and driven by a 350 hp motor.



American Blower Induced Draft Fans at the Cutler Plant have a capacity of 68,000 cfm at 350° F., with 9.7 inches wg. Four ABC Fans serve the steam generators for two 15,000 kw. units.



Each of the American Blower Forced Draft Fans at the Cutler Plant has a capacity of 40,500 cfm at 100° F., with 8.7 inches wg, and is rated at 114 bhp and driven by a 150 hp motor.

else, expand fast in Florida!

In fabulous Florida, everything grows fast . . . industry, agriculture, population — and electric power!

Florida Power & Light Company, for instance, has added 10 new generating units since V-J Day . . . and more are coming. Generating capacity is up 212 percent, more than double the national average. With a giant 135,000 kw. plant scheduled for completion in 1955, F P & L's system capacity will total 877,000 kw., or more than four times its end-of-the-war figure.

The Company's Cutler Plant, just south of Miami, is Florida's largest — a model of "outdoor" plant construction, blending ideally with its semi-tropical surroundings on the shores of picturesque Biscayne Bay.

American Blower products play a big part in F P & L's power progress. In the new 80,000 kw. unit at Cutler, two American Blower Induced Draft and two Forced Draft Fans are being installed. At the Company's new 80,000 kw. unit at the Riviera Plant near West Palm Beach, four similar American Blower Fans are already in service.

Are you planning to modernize or enlarge your facilities? Then get in touch with your nearest American Blower Branch Office (or write us direct) for full information on Mechanical Draft Fans, Dust Collecting Equipment and Gyrol Fluid Drives for boiler feed pumps and fan control.

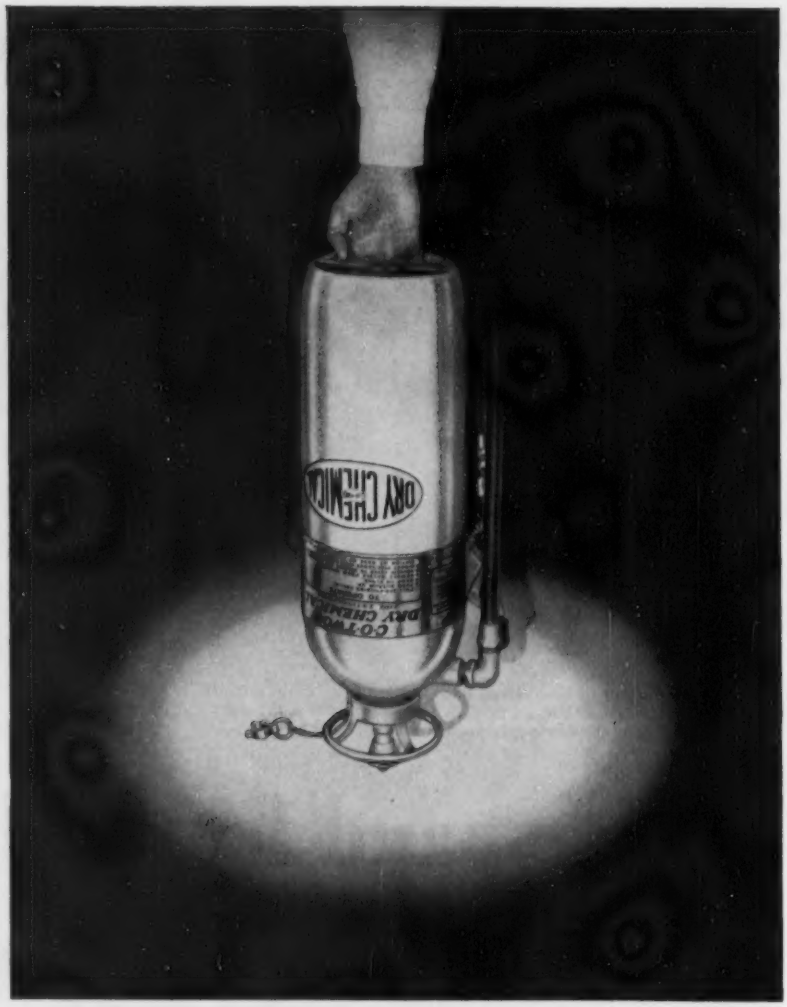
AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN • CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

Bump that assures positive results



When fire strikes, seconds count . . . your fire extinguishers must be the right type and function properly from the very start . . . failure means serious losses.

The growing popularity of the highly effective powdered dry chemical fire extinguishing agent may be hampered by a drawback . . . settling or packing can occur after a lapse of time. However, with C-O-TWO Dry Chemical Type Fire Extinguishers there's no chance of this happening.

The exclusive inverting and bumping design of C-O-TWO Dry Chemical Type Fire Extinguishers provides mechanical breakage of the dry chemical by shifting its position in the cylinder. This outstanding mechanical breakage, plus continuous inert gas pressured agitation or fluffing of the skillfully blended free flowing dry chemical, guarantee lasting, foolproof fire protection.

No other brand on the market today gives you this extra margin for positive results. Inverting and bumping is only one of many unique design advantages that make C-O-TWO Dry Chemical Type Fire Extinguishers your best buy for killing flammable liquid and electrical fires, as well as surface fires involving ordinary combustible materials.

With C-O-TWO Dry Chemical Type Fire Extinguishers the heat-shielding dry chemical is a non-conducting, non-abrasive, non-toxic, finely pulverized powder compound . . . blankets fire instantly. Sizes range all the way from 4 to 150 pounds capacity . . . all fully approved by the Underwriters' Laboratories, Inc., Factory Mutual Laboratories and Government Bureaus.

Act now for complete free information on these top quality, sure-acting fire extinguishers. Remember fire doesn't wait . . . get the facts today!

C-O-TWO

MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT

Squeez-Grip Carbon Dioxide Type Fire Extinguishers
Dry Chemical Type Fire Extinguishers
Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems
Built-In Smoke and Heat Fire Detecting Systems

C-O-TWO FIRE EQUIPMENT COMPANY
NEWARK 1 • NEW JERSEY

C-O-TWO FIRE EQUIPMENT OF CANADA, LTD. • TORONTO 8 • ONTARIO

Sales and Service in the Principal Cities of United States and Canada

AFFILIATED WITH PYRENE MANUFACTURING COMPANY

Reliable LIFTS THE LID on a New STRAIGHTLINE Splice

Internal assembly shows how conductors feed through as in a deadend. One jaw is removed for a better view.

SPLICE OPERATES LIKE A PAIR OF BACK-TO-BACK STRAIGHT-THRU DEADENDS

The new "55" Series Straightline Splice is the surest splice yet devised for strand . . . and *still* no tools are required.

FEATURES:

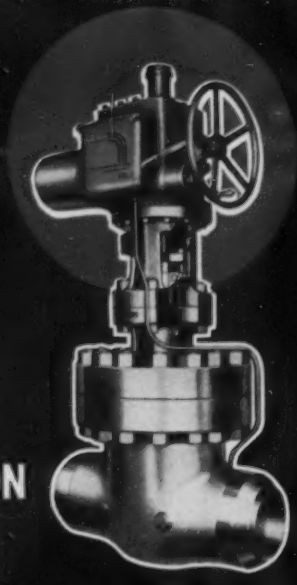
1. Burred, bent, or out-of-lay strands are either properly located or are refused by pilot cups.
2. Pilot cups prevent jaws from gripping conductor until conductor is "home".
3. Complete closure prevents entry of gritty materials that can interfere with proper functioning of gripping jaws.
4. With only a straight push conductors reach "home" with a definite *feel* and *sound*.

Write for new bulletin giving complete information. Reliable will gladly give you a demonstration — simply ask for it on your company letterhead.

Reliable ELECTRIC COMPANY
3145 CARROLL AVENUE
CHICAGO 12, ILLINOIS

OVER 45 YEARS OF SERVICE TO THE UTILITIES

POWER-LINE CONNECTORS and CONSTRUCTION SPECIALTIES



DEPENDABLE, SAFE AUTOMATIC OPERATION

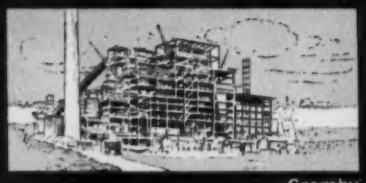
. . . keeps power plants sold on *Limitorque*®

PHILADELPHIA ELECTRIC COMPANY, one of America's Great Public Utility Organizations, has installed a total of 347 LimiTorque Motorized Valve Operators in seven of their famous Power Stations (5 of which are illustrated herewith).

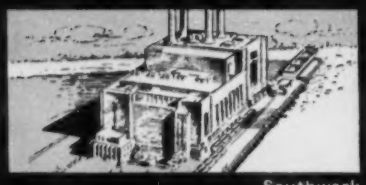
LimiTorque Valve Controls were chosen for their absolute dependability; speed of operation; saving in man-hours; out-of-the-way or hazardous location of valves;—and of course, for their automatic, positive remote operation by the "mere push of a button". What's more, LimiTorque absolutely prevents damage to valve stems, seats, discs, plugs or gates, . . . because the power is cut-off automatically should an obstruction be encountered in closing.

Thousands of LimiTorque Valve Operators are used in many prominent Central Stations; Power Plants; Water & Sewage Plants; Oil Refineries and Pipe Lines; Paper & Pulp Mills, and on Shipboard. Remember, far more LimiTorques are in use today, than any other make of Valve Operator. If you have a valve operating problem,—write us—and a Philadelphia Engineer will gladly call. Literature sent upon request.

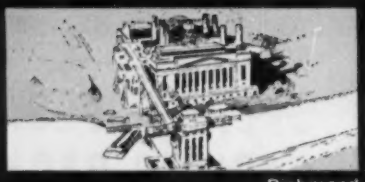
NEW OR EXPANDED PHILADELPHIA ELECTRIC POWER PLANTS



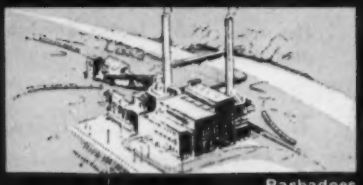
Cromby



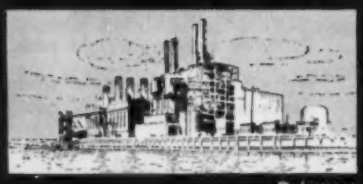
Southwark



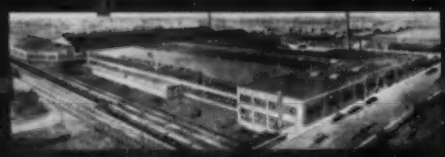
Richmond



Barbadoes



Delaware



PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

Industrial Gears & Speed Reducers

LimiTorque Valve Controls

Have you compared costs of weed control lately?

It's economical
because it's simple
and long-lasting
when you use

Du Pont "Telvar" W
Weed Killer

An application of "Telvar" W Weed Killer every year or two cuts maintenance costs around power stations like this. Weeds on the left show type of vegetation involved.

One spraying of as little as 40 to 60 pounds of Du Pont "Telvar" W per acre can get rid of vegetation *for a growing season or longer!* This powerful weed killer kills through the roots . . . remains in the ground to prevent new growth. Its lasting chemical action is just what's needed around power plants, substations, pole yards, storage yards, fencerows, etc.

Savings for You

With "Telvar" W on the job, you'll save labor and maintenance costs. A single spraying takes the place of laborious cutting and mowing . . . expensive multiple spraying. You eliminate the problem of storing and handling bulky weed killers, too. It all adds up to new efficiency in weed control—new economy in keeping key areas neat and trim.

Easy and Safe to Use

"Telvar" W is a wettable powder that mixes readily with water and is low in toxicity to humans and animals. Non-volatile, non-flammable and non-corrosive, it can easily be applied by standard spraying equipment.

Your Custom Sprayer Can Help

Specify "Telvar" W for this year's weed-control program. If you don't have spraying equipment, get in touch with a reliable custom sprayer to do your weed killing on an annual basis.

For more information about Du Pont "Telvar" W, clip and mail the coupon to E. I. du Pont de Nemours & Co. (Inc.), Grasselli Chemicals Department, Wilmington 98, Delaware.

Mail This Coupon
for Free Booklet

E. I. du Pont de Nemours & Co. (Inc.)
Grasselli Chemicals Department, Rm. D-4026
Wilmington 98, Delaware

☐ Please send me your booklet describing positive weed control with "Telvar" W. ☐ Send me the name of my nearest supplier.

Name_____ Position_____

Firm_____

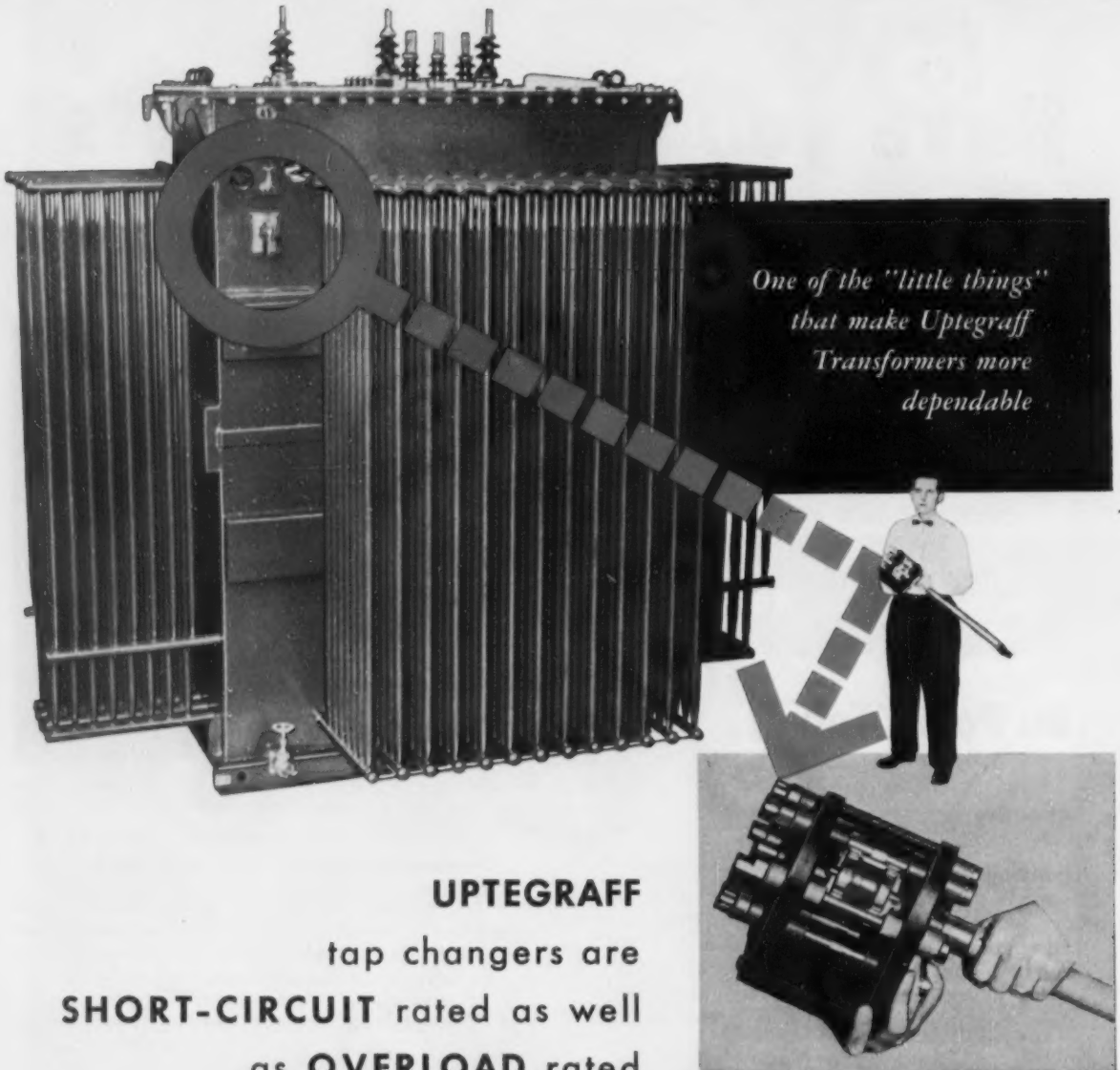
Address_____

City_____ State_____

DU PONT REG. U. S. PAT. OFF. **TELVAR W** TRADE-MARK
Weed Killer

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

On all chemicals always follow directions for application. Where warning or caution statements on use of the product are given, read them carefully.



UPTEGRAFF tap changers are SHORT-CIRCUIT rated as well as OVERLOAD rated

This *7500* KVA Uptegraff Transformer is designed and built with a full appreciation of the need for dependability in so-called "little things," as well as in the major parts of transformers.

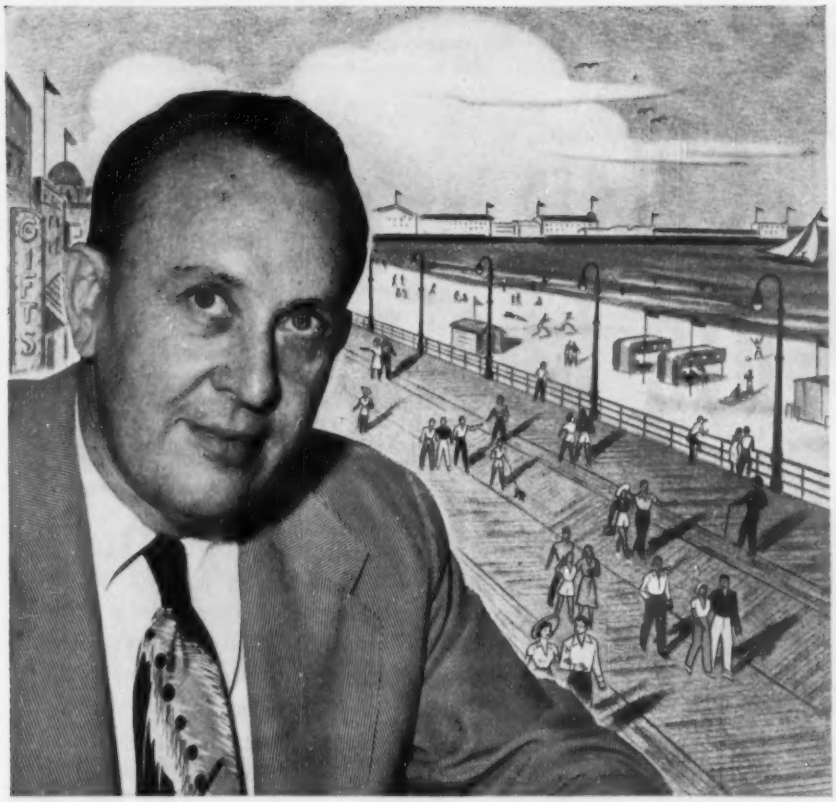
An example is the Tap Changer shown here. It is rated on the transformer for 60-second short-circuit. It is rated also for normal load and overload operation. Although, as the photograph shows, Uptegraff Tap Changers are sturdy in construction, it is *performance* that counts.

For long life, dependability, and overall economy, specify Uptegraff Transformers.

Shown above is one of three tap changer switches used for 3-phase power transformers, such as the one at top of the page. Snap-action contact assures positive operation.

R. E. UPTEGRAFF MANUFACTURING CO.

Scottdale, Pennsylvania



Iver C. Dixon, General Sales Manager of Atlantic City Electric Co., declares...

"We've increased commercial cooking revenues 600% in 5 years!"

5 years ago our annual commercial cooking revenues averaged under $50 for each of the 1200 restaurants, hotels, drive-ins and institutions in our territory. Today this figure tops $300—an increase of 600%.

In 1953 alone our income from the food-service industry went up $100 per establishment. That's $120,000 in new revenue. (New cooking load for the year topped commercial lighting load by a pretty fair margin.)

By the end of 1954 our income from commercial cooking will top $530,000. And from a source that 5 brief years ago produced negligible revenues.

Funny thing about this commercial cooking load, though . . . if we eased up on our promotional drive tomorrow (which, incidentally, we have no intention of doing!), new revenues would quickly slip back to the old levels.

That's because there's real competition for this much-sought-after load. (Unlike lighting, refrigeration and air-conditioning, it doesn't *have* to go electric, you know!)

Like a good many other utilities in this country, we're sold on commercial cooking . . . because of its high revenue . . . its really wonderful characteristics (you'll be surprised to discover how much of this load is off-peak) . . . and because it represents the most valuable service we could possibly render our food-service customer.

Frankly, we're in the commercial cooking field to stay.

WE SUBSIDIZE WIRING, BACK SALES WITH 24-HOUR SERVICE

L. C. Roe, commercial-industrial sales supervisor for A.C.E., discusses 7-Point Commercial Cooking program:

1 We maintain a year 'round commercial cooking activity intensified by a special 3-4 month campaign.

2 Our 14-man all-purpose team devotes 25% of its time to commercial cooking. The team's selling average for 1953 was 4.8 kw added per installation. The team's top man, Bill Howell, averaged 5 kw.

L. C. Roe

3 Elmer Williams, our commercial cooking specialist, is available at all times for consultation, and provides complete kitchen layout service.

4 We have top management's enthusiastic support.

5 We make a wiring allowance on all installations over 25 kw.

6 Loan equipment is always available for trial installation, or emergency use.

7 We offer 'round-the-clock service.

An example of public service performed by A.C.E. through the promotion of commercial electric cooking: famed Hackney's restaurant replaced 23 non-electric fryers with just 10 electric models with resultant higher efficiency.

THE TIME IS NOW

As Mr. Dixon pointed out—the field is intensely competitive, but highly profitable, carrying the added incentive of contributing to the modernization of the nation's food-service facilities.

Why not share our commercial cooking services and programs? Write and I will give your letter my personal attention.

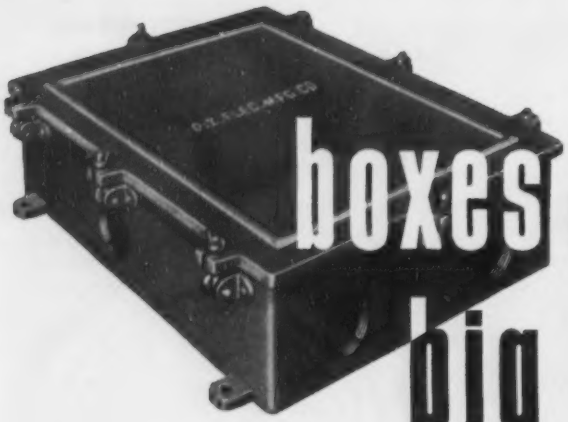
Orrin E. Wolf.

Orrin E. Wolf, Vice President, Hotpoint Co.

Hotpoint ALL ELECTRIC Commercial Cooking Equipment

Hotpoint Co. A Division of General Electric Company

Commercial Equipment Department, 265 South Seeley Avenue, Chicago 12, Illinois



boxes are big business at O.Z....

So big, in fact, that our junction box manufacturing facilities are located in a new 35,000 square foot plant. Here, in a modern building, are men, equipment and space to fabricate a complete line of surface and flush-mounting junction boxes for every application and requirement. A large stock is maintained at all times for speedy delivery. Your O. Z. distributor is now in a better position than ever to fill your needs.

Modern equipment for fabricating junction boxes in this O. Z. box plant means greater efficiency for us . . . better service for you.

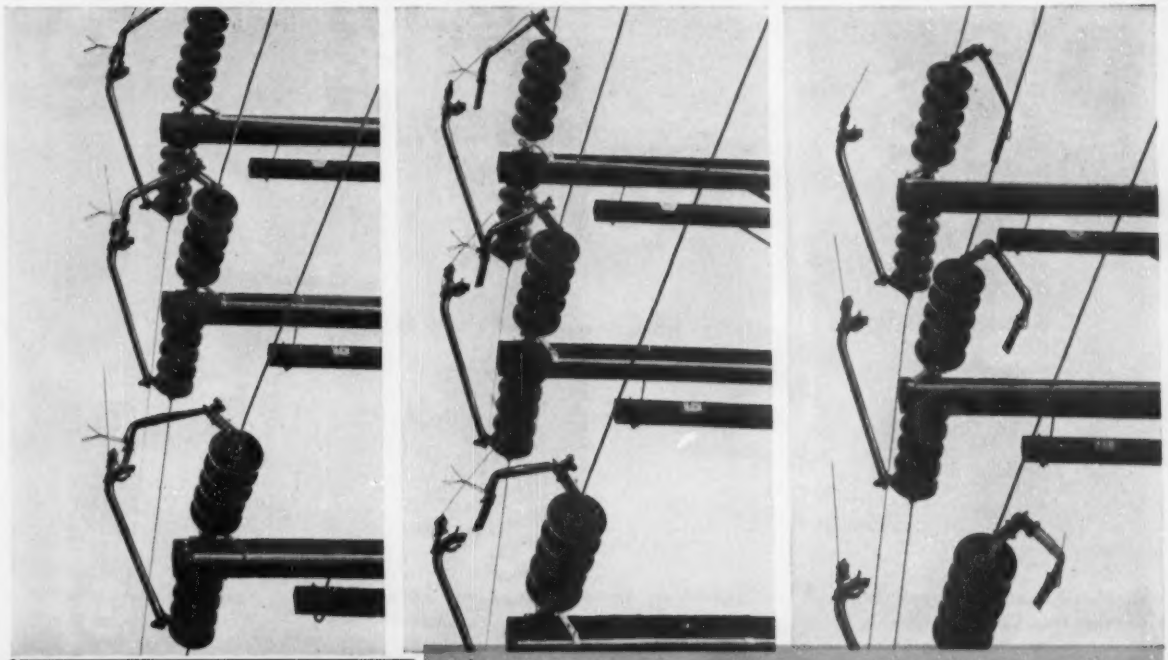
Greatly increased stock assures a constant supply of standard junction boxes and speedy processing of your orders.

O.Z. ELECTRICAL MANUFACTURING CO., INC.

262 BOND ST. • BROOKLYN 17, N. Y.

CAST IRON BOXES • SOLDERLESS CONNECTORS
CABLE TERMINATORS • GROUNDING DEVICES
POWER CONNECTORS • CONDUIT FITTINGS

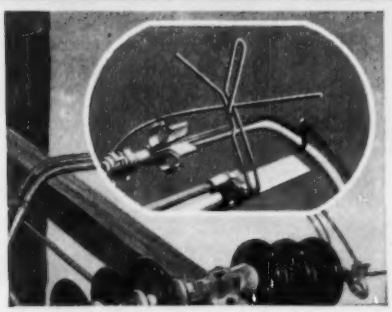
KPF Type S switch, vertical mounted, with Quick-Break. *(Left,* switch closed. *Center,* switch opening, Quick-Break still maintaining contact, preventing arc. *Right,* KPF Quick-Break whips free in split-second, preventing establishment of arc). *Photos reproduced from September, 1949* ELECTRICAL WEST.



KPF

AIR BREAK SWITCHES

Standard for nearly half a century



The secret of the system-proved KPF Quick-Break is a heat-treated beryllium copper "cat's whisker" which whips free in a split second as the rotating arm of the switch is opened. The design and extremely high acceleration of the mechanism prevent establishment of an arc. Thus, critical arc length is not a problem. Quickly, simply installed on switches now in use.

2592

Service-proved KPF Quick-Breaks safely drop 40 miles of 60 kv line

Operating engineers tell us KPF switches with the time-tested Quick-Break are the most outstanding air break switch improvement in over three decades.

Before introduction of this simple, sturdy Quick-Break, pole top switching of 69 kv circuits was limited to some 6 miles of line. Now, operating experience of utilities and power companies shows 40 miles of 69 kv line can be dropped with safety.

KPF Quick-Breaks, like KPF switches, are simple and ruggedly constructed for long life, trouble-free operation under all weather conditions, economical installation and low cost.

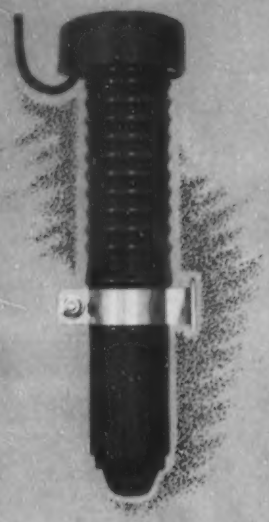
KPF Quick-Break attachments, first developed in 1944, are available for all KPF switches built since 1940.

New catalog gives complete specifications, mechanical details and installation information.

KPF ELECTRIC COMPANY

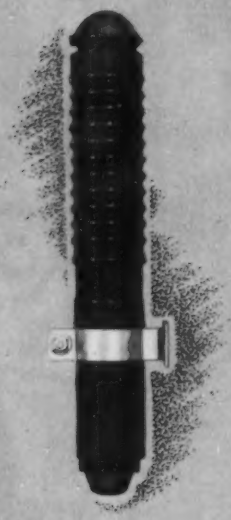
1624 East Alpine Avenue, Dept. E-3, Stockton 5, California

COMPLETE LINE



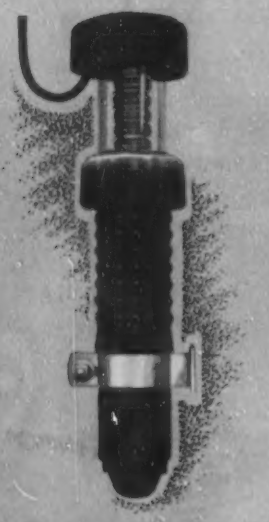
Non-Ventilated Spark Gap Construction.
Line Lead-Ground Stud Terminals

Non-Ventilated Spark Gap Construction.
Line Stud-Ground Stud Terminals

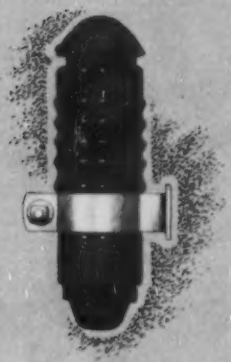


Ventilated Spark Gap Construction.
Line Stud-Ground Stud Terminals

PERFORMANCE-PROVED THROUGHOUT THE WORLD



Ventilated Spark Gap Construction.
Line Lead-Ground Stud Terminals



Ventilated Spark Gap Construction.
Line Stud-Ground Stud Terminals

Ventilated Spark Gap Construction.
Line Stud-Ground Stud Terminals

ELECTRIC SERVICE MANUFACTURING CO.

Proved Protection

...for every distribution line

CRYSTAL VALVE ARRESTERS

Whatever the type, voltage or location of your distribution lines or transformers for distribution lines there's a Crystal Valve Arrester "Job Engineered" to give maximum protection in all types of weather and lightning conditions.

CRYSTAL VALVE VENTILATED GAP ARRESTER

High-speed, multiple arcing spark gap unit protected from corrosion by vents which permit the movement of air . . . prevent the accumulation of moisture in the housing. These vented gap arresters are available in both all-porcelain and porcelain-glass housings. Their amazing all-round performance is proved by the thousands in service which have achieved better than 99% perfect protection. Range in maximum permissible line-to-ground voltages of 3,000 to 18,000.

CRYSTAL VALVE SEALED TYPE ARRESTER

Embodies time-proved accurately spaced, high-speed multiple spark gap units and electrodes with discharge surfaces that are smooth and flat. Oxidized Silicon Carbide valve element provides low discharge voltage drop and high discharge capacity . . . true valve action in conjunction with high-speed spark gap assembly interrupts follow current if present . . . no measurable deterioration after years of service. Range in maximum permissible line-to-ground voltage of 3,000 to 25,000.

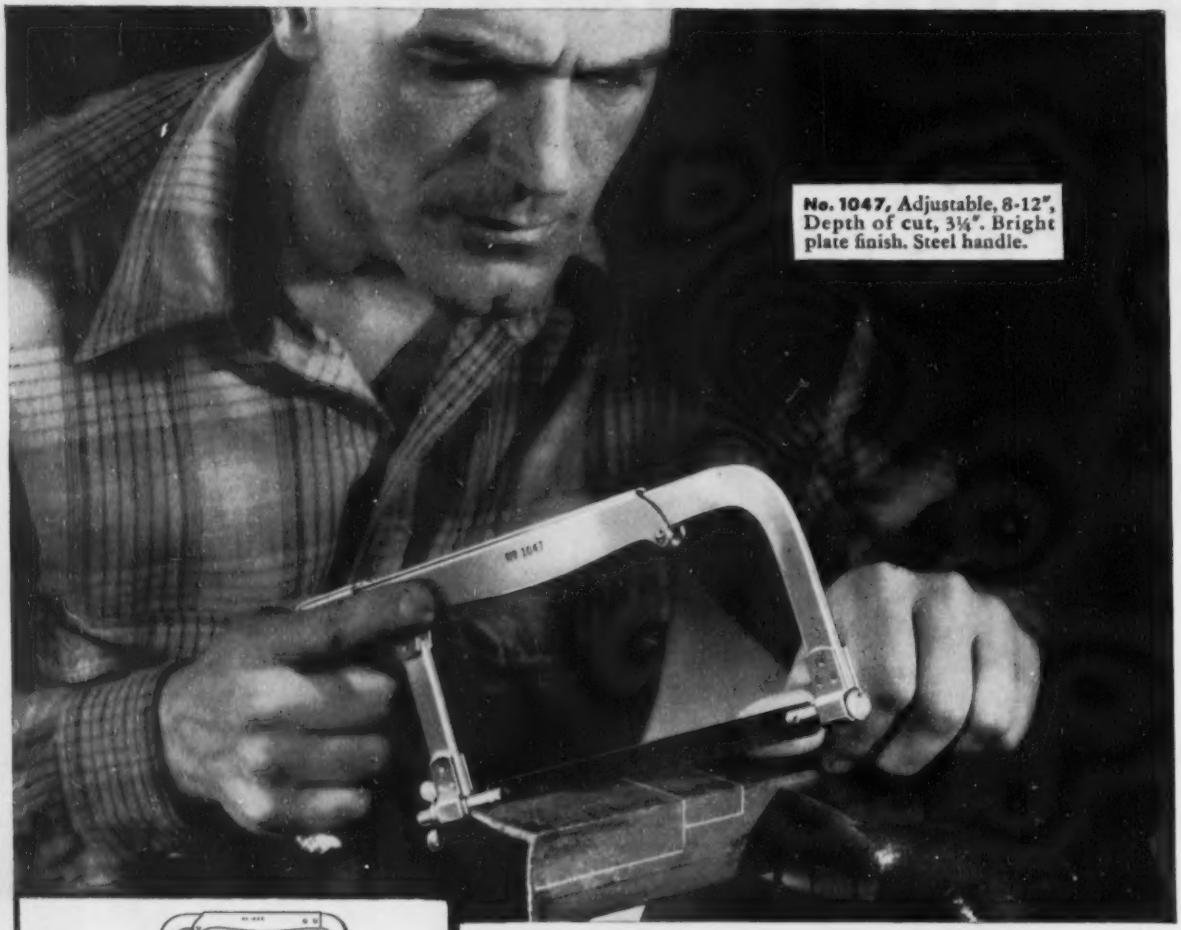
To be certain your lines and transformers have maximum protection at all times let Electric Service engineers show you how "Job Engineered" Crystal Valves assure positive protection.

Write for your copy of "Proved Protection"—giving all of the inside facts you should consider in selecting lightning arresters.

CRYSTAL VALVE LIGHTNING ARRESTERS

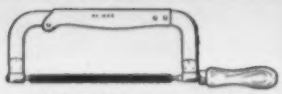
Philadelphia 32, Penna.

Represented in Canada by Lyman Tube and Bearings, Ltd., Montreal and Toronto



No. 1047, Adjustable, 8-12", Depth of cut, 3⅛". Bright plate finish. Steel handle.

No. 1042



Adjustable, 8-12". Depth of cut, 2½". Bright plate finish. Wood handle.

No. 1046

Adjustable, 8-12". Depth of cut, 2½". Bright plate finish. Steel handle.

No. 1049

Adjustable, 8-12". Depth of cut, 3¼". Bright plate finish. Neoprene handle.

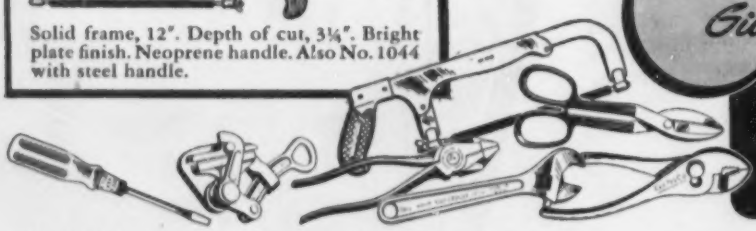
No. 1044N

Solid frame, 12". Depth of cut, 3¼". Bright plate finish. Neoprene handle. Also No. 1044 with steel handle.

CRESCENT HACKSAWS

● Strong, rigid, well-balanced Crescent Hacksaws are designed for the exacting mechanic. Choose from five popular patterns having wood, steel or Neoprene handles. The Neoprene handles are far superior to plastic. They are impervious to oil and acid, unaffected by extremes of heat or cold, have high dielectric value and are practically unbreakable. Sold by Industrial Distributors and Hardware Dealers everywhere.

CRESCENT TOOLS
Give Wings to Work
®
Sign of the Artisan
Symbol of Excellence



Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

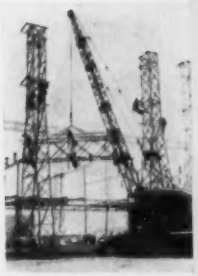
Pacific Structure Switch Units ... Cut Costs, Improve Switching

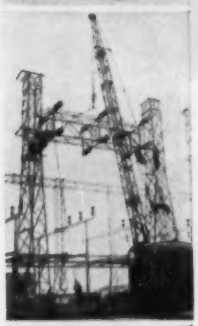
PACIFIC ELECTRIC

INTEGRATED-DESIGN (I-D) STRUCTURE SWITCH UNITS

for many air-switch applications of Disconnecting, Sectionalizing, By Pass, Bus Transfer and Tie—15 kv to 115 kv

Other styles 7.5 kv to 330 kv





Top Photo — 6-pole unit hoisted
Center Photo — 6-pole unit in place
Bottom Photo — 3-pole unit hoisted

USUAL PRACTICE

1. Buy air switches.
2. Design, buy, and erect structure.
3. Mount switches on structure.

PACIFIC I-D PRACTICE

1. Buy integrated-design (I-D) structure switch units.
2. Erect them.

The three small views at left show four men and a crane erecting two Pacific structure switch units (110-5 kv) on tower column . . . Total Time ½ hour

50-ft. apparatus tower, 115 kv, with 6-pole Pacific YVW disconnecting switch and 3-pole YVW by-pass switch.

WHERE APPLICABLE, Pacific Electric Structure Switch Units of integrated design (I-D) reduce erection time, improve switch rigidity and alignment, and simplify control linkage.

Consider the pictured apparatus tower, for example—designed for disconnecting and by-pass (or bus tie) of a 115-kv circuit breaker. The six-pole disconnecting switch is an integral part of the box frame structure. Any two opposite insulator stacks are merely extensions of a single rotating "through" shaft. The shaft bearings support dead weight only; they do not have to resist cantilever stresses.

The PACIFIC (I-D) Structure Switch Units used in this tower provide the following advantages as compared with conventional construction . . .

- Eliminates six switch bases and fastenings.
- Eliminates one inter-phase control rod assembly.
- Switch alignment improved because bearings are not subjected to cantilever stresses. This permits greater leeway in bearing design. In these units the shafts run on stainless-steel rollers confined between stainless-steel inner races and bronze outer races —all protected by Neoprene shielding.

Pacific Structure Switch Units of Integrated Design (I-D) are not applicable to all conditions of air-switch installations. But a check of air-switching problems with Pacific Electric will disclose where they can be used to advantage.

Since 1906

SALES OFFICES or AGENCIES in PRINCIPAL CITIES

PACIFIC ELECTRIC MFG. CORPORATION

SUBSIDIARY OF FEDERAL ELECTRIC PRODUCTS COMPANY

5815 THIRD STREET, SAN FRANCISCO 24, CALIFORNIA

OTHER FACTORIES: SANTA CLARA, CALIF.; SCRANTON, PENNA.

Chase Antimonial Admiralty

Every Chase Antimonial Admiralty condenser tube is tested to withstand at least 1,000 pounds per square inch water pressure.

Meets every test for Condenser Tubes

Chase flattening test, index of Antimonial Admiralty tube's physical quality and ability to withstand bending or end flaring.

This Chase metallurgist is checking the size and uniformity of grain of Chase Antimonial Admiralty condenser tubes.

When you put Chase Antimonial Admiralty tubes into a condenser you *know* they'll stand up for years. It isn't only that we make certain there's enough antimony to resist dezincification. Chase condenser tubes are carefully tested and retested for *every* physical and chemical property required to meet actual field conditions. It pays to insist on Chase Antimonial Admiralty.

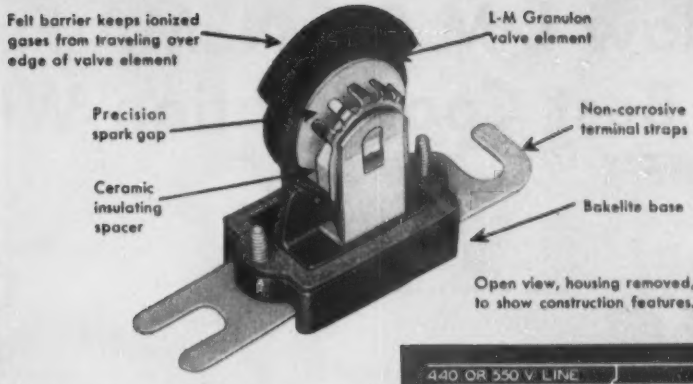
Chase BRASS & COPPER

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper

Albany †	Cleveland	Kansas City, Mo.	New York	San Francisco
Atlanta	Dallas	Los Angeles	Philadelphia	Seattle
Baltimore	Denver †	Milwaukee	Pittsburgh	Waterbury
Boston	Detroit	Minneapolis	Providence	
Chicago	Houston	Newark	Rochester †	(† sales offices only)
Cincinnati	Indianapolis	New Orleans	St. Louis	

New L-M Type L Signal Arrester
—1¼ Times Actual Size


Felt barrier keeps ionized gases from traveling over edge of valve element
L-M Granulon valve element
Precision spark gap
Non-corrosive terminal straps
Ceramic insulating spacer
Bakelite base

Open view, housing removed, to show construction features.

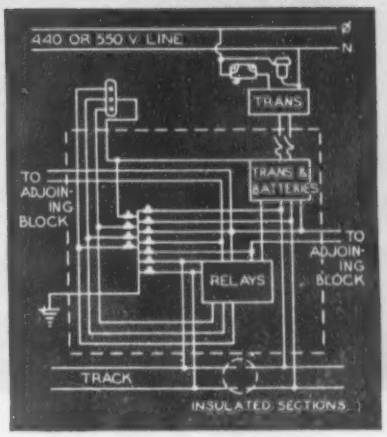


Diagram shows application of L-M Type L Signal Arresters to an automatic block signal control. Arrester may also be used to protect relays on station and yard lighting systems.

KEY TO DIAGRAM

- Signal Lightning Arresters
- Distribution Lightning Arresters
- Secondary Fuse Cutouts

L-M's Low Voltage Lightning Arrester Designed for Signal System Protection

L-M's new Type L Signal Arrester is a valve type arrester that provides excellent lightning protection for low voltage circuits up to 30 volts DC or 175 volts AC. The arrester meets all requirements of the AAR Signal Section Specifications 52-51.

The Type L provides protection for railway signal circuits, low voltage track and line circuits, and centralized traffic control circuits. The arrester assures dependable, complete protection of line and track relays, track transformers, and battery circuits. Although it is primarily designed for railway signal systems, its versatility permits it to be easily applied to other low voltage systems, such as fire alarm circuits, airport lighting circuits, meters, and relays.

The L-M arrester has high discharge capacity to drain off lightning surges and protect equipment. It also provides rapid interruption of the DC or 60-cycle AC current that follows the lightning surge path to ground.

Visual Inspection

The arrester is watertight, sealed in a transparent plastic housing, which makes possible instant visual inspection. It consists of a precision spark gap; a valve element, the same as used in L-M's distribution arresters; a strong bakelite base; and non-corrosive terminal straps. It is designed for, and available with, the standard AAR porcelain mounting block.

The Type L arrester has a consistent impulse sparkover of 2700 volts, well below the 3400-volt AAR specification. A minimum 60-cycle sparkover of 1100 volts permits circuits to be tested with 1000-volt meggers without removing the arresters from the circuit.

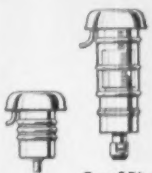
Each arrester easily withstands the duty cycle test of 30 shots of 1500 surge amperes on a 10 x 20 microsecond wave without changing its characteristics.

Get Complete Information

Details of the design, features, and application of L-M's Type L Signal Arrester are covered in an informative Bulletin LA6. Ask the L-M Field Engineer for a copy; or write Railway Sales Division, Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

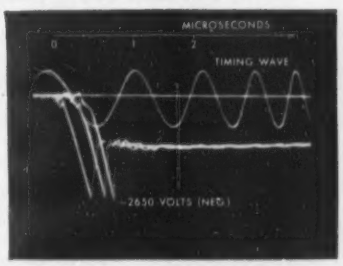
Other L-M Lightning Arresters

Line Material Company makes a complete line of lightning arresters for signal systems, secondary, and primary distribution systems. If you are interested in these, also ask for copies of Bulletins LA2, LA4.

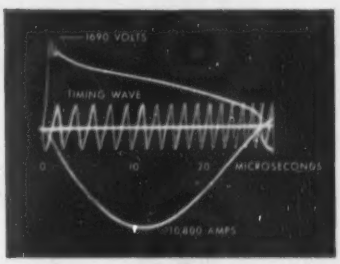


Secondary Arrester—0 to 650 Volts

Type E Distribution Arrester—3 to 15 kv



Impulse Sparkover of Type L Arrester. Oscillogram shows three successive shots on a wave rising 10 kv per microsecond. Note that all sparkover values are equal.



Discharge capacity withstand showing the Type L Arrester passing a 10 x 20 microsecond wave of 10,800 surge amperes (AAR only specifies a 5 x 10 ms wave). The IR drop curve shows the arrester withstanding the discharge.

LM® LINE MATERIAL *Lightning Arresters*

How L-M EEI-NEMA Fuse Links Give Best Coordination With Reclosers

by **R. W. KELLY**
Application Engineer
Protective and Switching
Equipment Division
Line Material Company

The introduction of dual timing in Kyle Reclosers opened a new field in coordination, and made possible the recloser-fuse coordinated systems. For a number of years, L-M "N"-rated Unifit links have done an excellent job of coordinating with reclosers. Today, through the use of L-M EEI-NEMA fuse links, the application of recloser-fuse systems has been further broadened.

Broader Range of Coordination

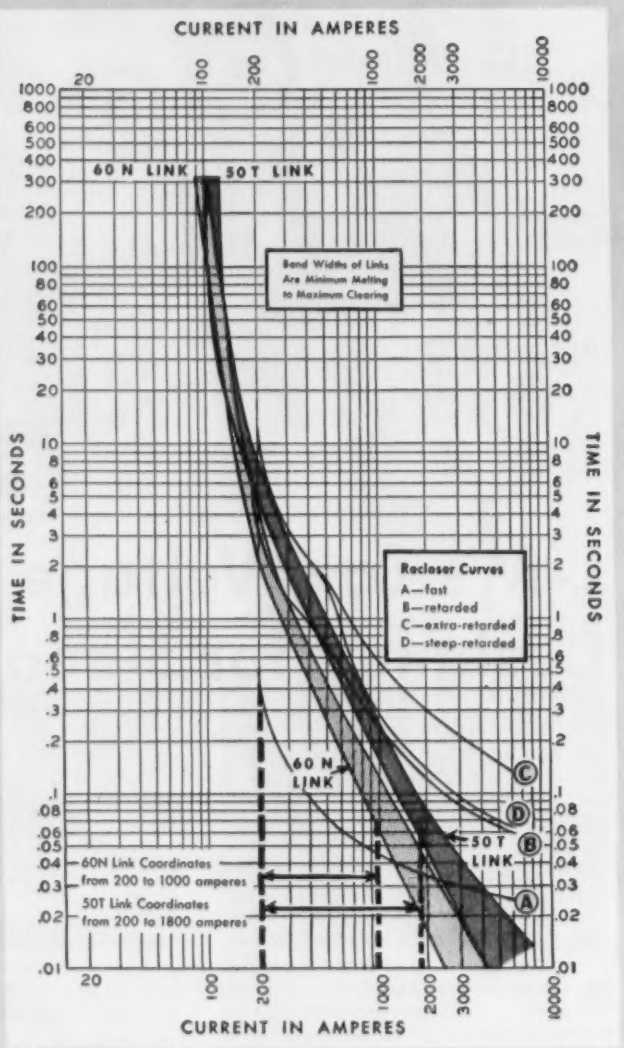
L-M EEI-NEMA links give a maximum range of coordination between reclosers and branch fuses. The improvement is illustrated by the example in the curves at the right, showing how EEI-NEMA links give even a broader range of coordination than the L-M "N" links.

Excellent coordination with reclosers is provided by both the L-M "T" and "K" EEI-NEMA links. The "T" link is particularly well suited because of its medium-slow characteristics. Yet it is not so slow that load current carrying ability is sacrificed.

L-M Links 100% Tested!

L-M EEI-NEMA links are made under close quality control. *Every* link is tested. It is subjected to a telltale resistance test, to check electrical accuracy. It is also given a 25-pound pull test to assure its mechanical strength.

L-M's CONVENIENT PACKING: L-M EEI-NEMA links come in handy 5-cell cartons. Each link is in a separate cell. Perforations make it easy to tear off one cell at a time, and to break off the end of the cell to remove the link. These cartons in turn are boxed for easy storeroom handling and distribution in 25-link packages and 100-, 150-, and 250-link cartons.



Comparison of time current curves of an L-M-Kyle type "L" 100-ampere recloser and 60N and 50T fuse links. The 60N links will coordinate in a range of from 200 amperes to 1000 amperes; the EEI-NEMA type "T" links will coordinate with the recloser from 200 to 1800 amperes.

Complete Coordination Data

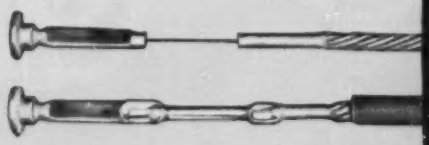
L-M makes available Bulletin FC5A on EEI-NEMA links, coordination tables, interchangeability tables for replacing "N" links of various makes, and a paper on the coordination of fuse links with reclosers.

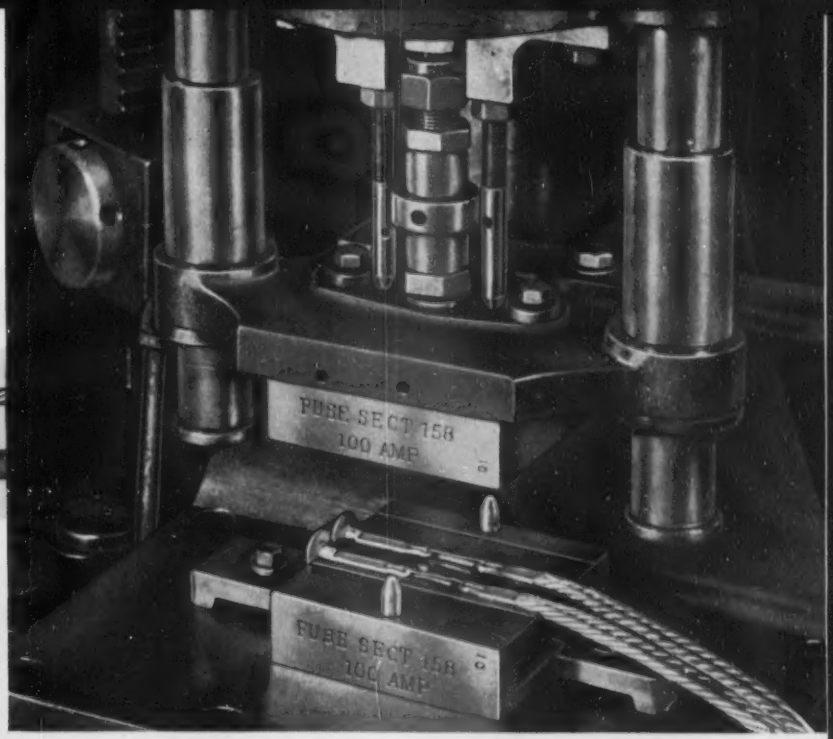
Ask the L-M Field Engineer for copies of this literature; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

169

LINE MATERIAL
fuse cutouts and fuse links

L-M die-cast tin links are accurately made in this hydraulic-operated mold. The precision mold and accurate operation assure a high degree of uniformity in L-M EEI-NEMA fuse links. Photo below shows links before and after die-casting.





Each L-M EEI-NEMA fuse link is individually tested on this machine, which applies a 25-pound pull at the same time the link gets a millivolt-drop test to assure precise electrical characteristics.

PACKAGING—All links are packaged in cartons of 5 cells (3 cells for links above 100 amperes). These 5-cell units come in cartons of 25 links, which in turn are packed in large boxes of 100, 150 and 250 links each. All cells, cartons, and boxes are clearly marked with rating and link type.

When You Switch to EEI-NEMA Links, Get L-M Quality Control, 100% Testing

For many years we at L-M have prided ourselves on the dependable accuracy of L-M fuse links. This uniform accuracy is of course important in assuring coordination.

The same quality control developed over a number of years has now been applied to the manufacture of the new EEI-NEMA-standard links. L-M procedures include precision die-casting, which applies the accuracy of precision production to fuse link manufacture. Materials and methods are closely controlled to assure the closest possible adherence to established standards.

100% Testing

Every link is given a 25-pound pull test. This is well in excess of the NEMA-standard 10-pound test, and gives extra assurance that L-M links will meet the strain of any type of fuse cutout. At the same time all L-M EEI-NEMA links are given a millivolt-drop test to assure accurate electrical characteristics.

One-Piece Construction

Button and shank are forged in one piece. This one-piece construction eliminates an additional joint through which current would flow, and is an important contribution to the low temperature at which L-M links operate. Buttons and shanks are tin-coated to prevent corrosion and assure good electrical contact.

Clear Identification

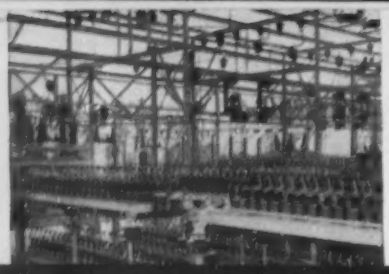
Buttons are clearly stamped on top with the link rating. This rating is followed by the letter "K" or "T" to indicate the type. L-M High Surge links are identified by the letter "H."

Get This Complete Bulletin

A new Bulletin FC5A on EEI-NEMA links gives details on ratings, time-current curves, and application in coordination problems. Ask the L-M Field Engineer for a copy; or write Line Material Co., Milwaukee 1, Wis. (a McGraw Electric Company Division).

LINE MATERIAL

fuse cutouts and fuse links



L-M's New VDS Method

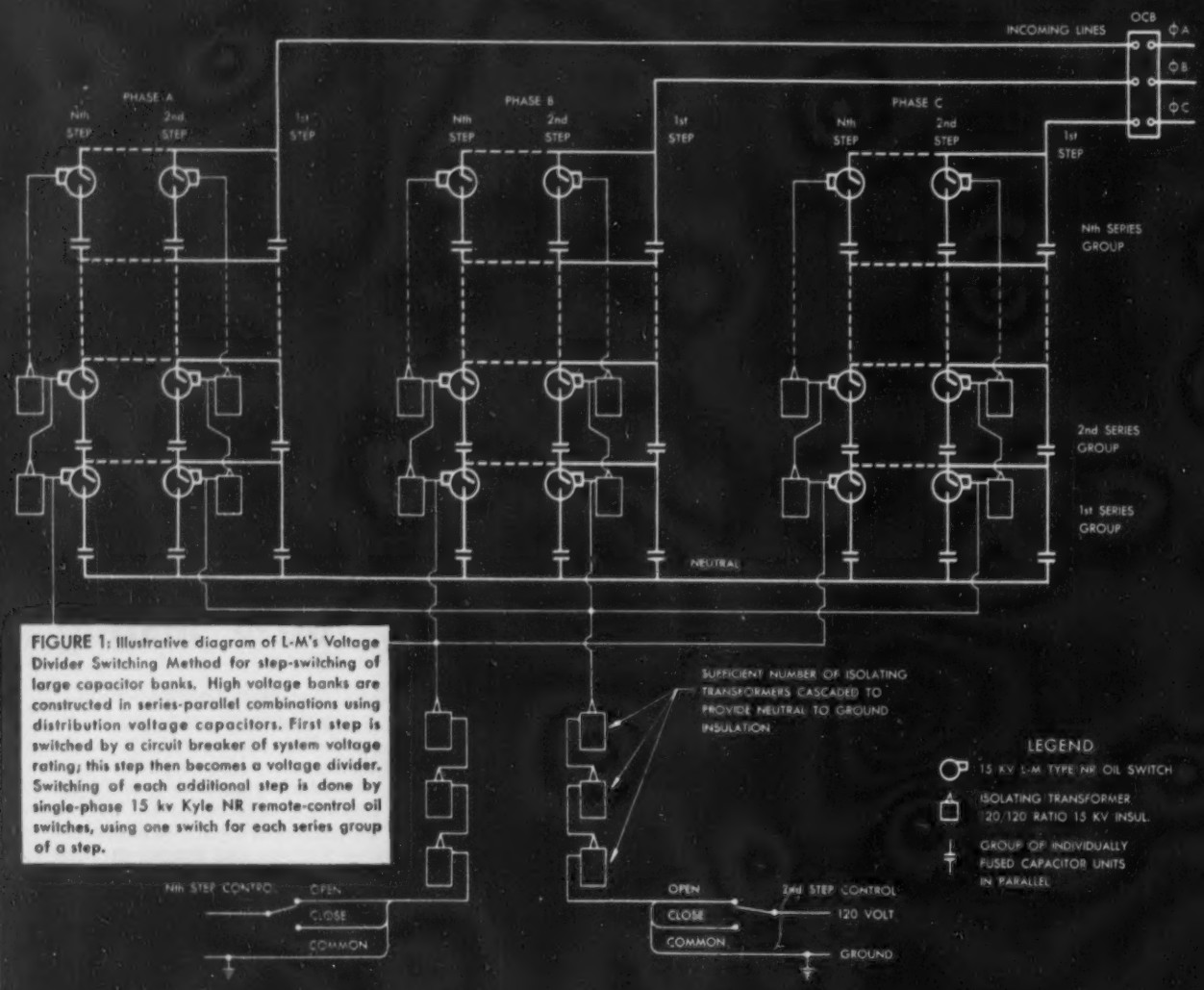
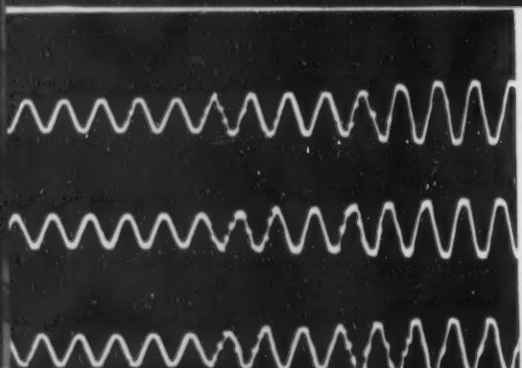
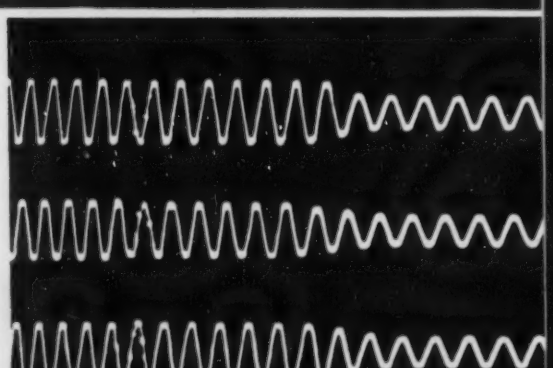


FIGURE 1: Illustrative diagram of L-M's Voltage Divider Switching Method for step-switching of large capacitor banks. High voltage banks are constructed in series-parallel combinations using distribution voltage capacitors. First step is switched by a circuit breaker of system voltage rating; this step then becomes a voltage divider. Switching of each additional step is done by single-phase 15 kv Kyle NR remote-control oil switches, using one switch for each series group of a step.





Oscillograms show that the random operation of a number of switches, all within approximately ½ second, eliminates any system disturbance. Figures 2 and 3 show the switching on and off of a 5250 kvar step of capacitors at 46 kv by 21 Kyle oil switches comprising seven series groups per phase. The current increases or decreases smoothly as the 21 switches operate at random times.

FIGURE 2—ON

FIGURE 3—OFF

Cuts Capacitor Switching Costs 40%

L-M develops low-cost method of switching large multi-step capacitor banks. Known as the Voltage Divider Switching Method (patent applied for), this method permits substituting low-cost 15 kv oil switches for circuit breakers on all but the first step of multi-step banks from 23 to 230 kv.

by **P. M. MINDER**
Application Engineer
Line Material Company

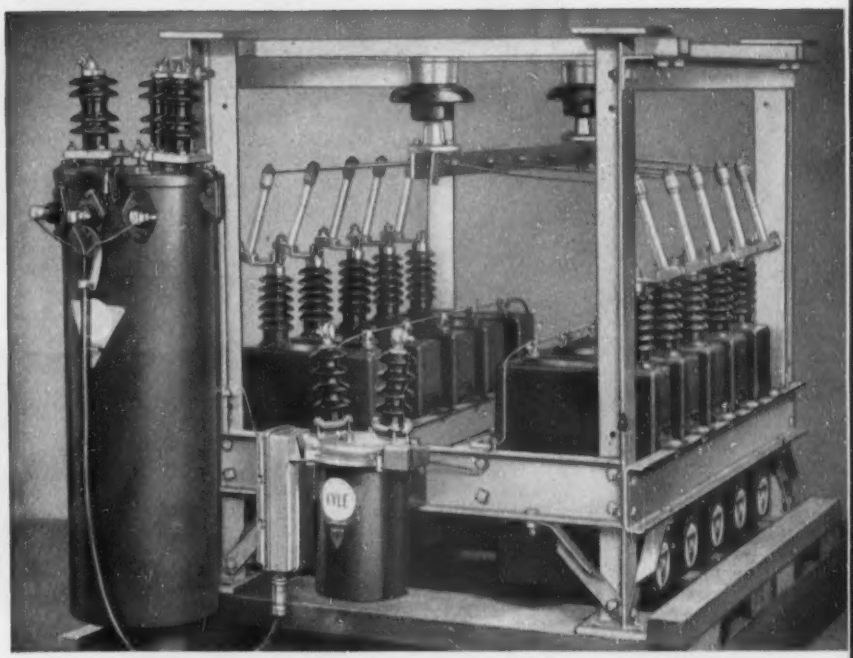
With the trend toward installation of capacitors on transmission and subtransmission circuits, capacitor switching has become a problem of economics. Large banks sometimes must be switched in a number of steps. The conventional practice requires a large breaker for each step. Thus the cost of switchgear for these large multi-step banks may become prohibitive.

L-M's Voltage Divider Switching Method utilizes L-M's Kyle NR remote-control 15 kv oil switches on all but the first step of a large bank. While a number of these switches are required, they cost only about $100 each, and even a number of them cost far less than a large breaker.

Cost Cut 40%, For Example

Here is an example of the comparative cost of switching by the conventional method and the VDS Method. Figures are based on a bank rated at 69 kv, 15,750 kvar, with 3 steps, each 5250 kvar.

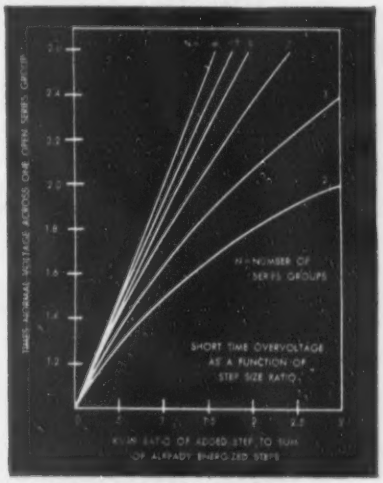
Figures include cost of switching equipment only. They do not include cost of automatic control equipment in either case. Nor do they include cost of installation, or the saving in foundations for two additional large breakers. It is evident that, in any case, the use of the VDS Method offers substantial savings. Discussion with one of the L-M Field Engineers will help you arrive at reasonably close figures for any individual application.



L-M's new factory-assembled stacking unit. The unit includes ten or more 25 kvar capacitors and the required fuses, Kyle NR switches, and isolating transformers mounted on the end of the frame. These stacking units are available in sizes from 250 to 600 kvar.

Figures Show What You Can Save With L-M's VDS Method

Conventional Method:	
1 OCB, 2500 MVA interrupting capacity; cost, about	$20,000
2 OCB's, 1000 MVA interrupting capacity; cost, about $13,500 each	27,000
Total, about	$47,000
Voltage Divider Switching Method:	
1 OCB, 2500 MVA interrupting capacity; cost, about	$20,000
2 switched steps using 30 Kyle NR switches (15 in each step) and equipped with all necessary isolating transformers and insulators; cost, about	8,400
Total, about	$28,400
Saving, VDS Method over conventional, about	$18,600



Overvoltages occur on the various series groups during switching. The highest overvoltage occurs when all but one switch of the second step are closed. These overvoltages are of brief duration and are kept at a safe magnitude by proper bank design.

Get Complete Information—Details of the new L-M Voltage Divider Switching Method (patent applied for) are available in a technical paper. Ask the L-M Field Engineer for a copy, and for information about L-M's Capacitor Application Engineering Service. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

170

LINE MATERIAL *Elemex Capacitors*

Like an evil eye, fire is constantly on the lookout for unprotected hazards such as flammable liquids, electrical equipment, materials in process. Get protection that never sleeps. Guard every hazard in your plant with a Kidde Automatic Fire Extinguishing System.

Quick as a wink, check the 'yellow pages' for your local Kidde dealer.

The words 'Kidde', 'Fyre-Freez' and the Kidde seal are trademarks of Walter Kidde & Company, Inc.

Kidde

Walter Kidde & Company, Inc.
430 Main St., Belleville 9, N.J.
Walter Kidde & Company of Canada, Ltd., Montreal—Toronto

three tapes
...one quality
GOLD SEAL

FRICTION
Get the most "coverage" for your money with tape that goes *further* . . . say Gold Seal.

RUBBER
Get the splicing compound that sticks fast, speeds the job . . . say Gold Seal.

PLASTIC Get Gold Seal quality in plastic electrical tape. Highly elastic, it "flows" on to cover any surface snugly. Neat, thin wrapping gives all needed dielectric on most jobs. Sticks on — stays on — resists sunlight and weather — defies water, oil, solvents. Single 60 ft. rolls, cellophane protected, are packed in round metal cans. "Tape-saver" 20 ft. rolls, sized to meet average job needs and "swing" easy in tight places, are packed in 10-roll Handy Pack containers. Sample free on request. Jenkins Bros., Rubber Division, 100 Park Ave., New York 17.

JENKINS

Gold Seal Tape

FRICTION • RUBBER • PLASTIC

Also Diamond Seal Friction and Rubber Tapes made to ASTM Specifications. Products of Jenkins Bros. — makers of famous Jenkins Valves.

Every year... more of the nation's power flows through I-T-E Isolated Phase Bus

Bus applications growing

In 1936, I-T-E pioneered the isolated phase principle of bus design. Every year since, I-T-E Isolated Phase Bus has delivered an ever-increasing percentage of the nation's generated power. Today, about 25% of total capacity flows through I-T-E Bus. Some 35 conductor-miles—280 installations—are now in service.

Reasons for growth

Generators are getting bigger and bigger. I-T-E Bus—with each phase completely isolated from the others—is perfectly planned for carrying the heavy currents generated by these power giants.

I-T-E engineers have long experience in applying generator leads in the country's largest power projects. In both installation cost and actual performance, I-T-E has established a record for economy that is hard to match.

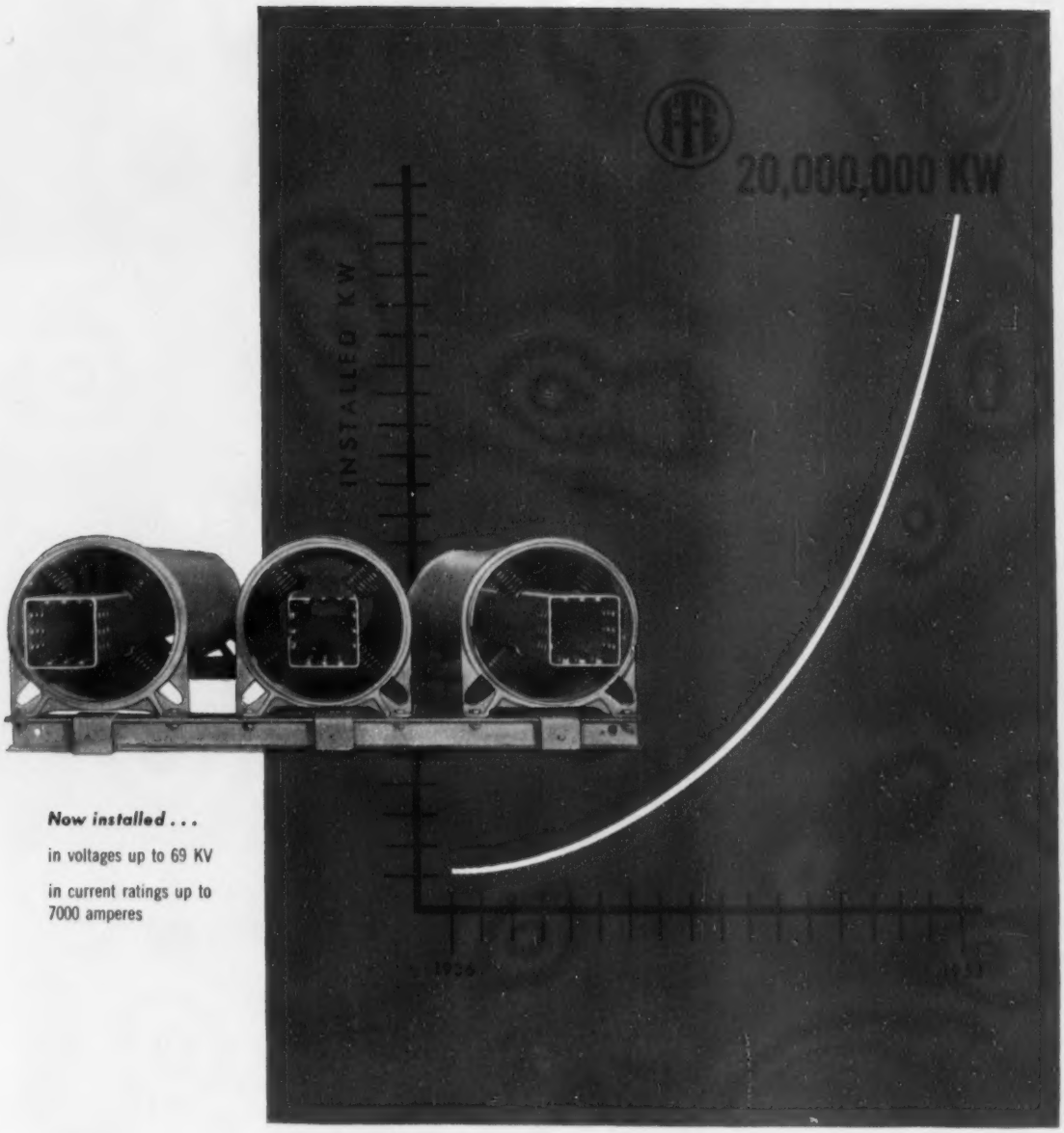
Design adaptability

Simple construction makes it easy to adapt I-T-E Isolated Phase Bus to a variety of requirements. Indoors or outdoors, on long runs or short runs, it can be readily adapted to irregular building contours. Unit-welded sections reduce installation cost on straight runs. But complicated connections—even those necessary in existing structures—are all provided for in the standard I-T-E design.

Time-tested design

I-T-E's original design has survived the test of more than fifteen years. Today, I-T-E Isolated Phase Bus has become the generally accepted design for heavy power conductors.

A tremendous power growth is forecast for the years ahead. I-T-E is prepared to meet this challenge and to serve the power industry with design experience and production capacity.



Now installed . . .

in voltages up to 69 KV

in current ratings up to 7000 amperes

I-T-E ISOLATED PHASE BUS

I-T-E CIRCUIT BREAKER COMPANY • 19th & Hamilton Sts., Philadelphia 30, Pa.

R&IE R&IE EQUIPMENT DIVISION, Greensburg, Pa.

STRONGER THAN THE PIN

In laboratory tests to determine the torsion strength of Kimble *Tempered* Glass Insulators, wood pins were sheared off, and lead-bushed threads stripped, with no failure of the Insulators. Cantilever tests using special alloy pins were discontinued at 10,000 lbs. with still no failure. Ultimate impact tests averaged 130 inch pounds!

Kimble *Tempered* Glass Insulators save installation time because it's never necessary to loosen for lineup with the conductor. Their great strength always allows another quarter-turn.

If it's on the pin, it's in service

Tests far in excess of A.I.E.E. standards have proved it impossible to puncture a Kimble *Tempered* Glass Insulator in air. Even lightning surges have failed to damage them. In the event of shattering due to severe mechanical shock, insulator disintegrates into small, non-sharp fragments. Trouble shooters can locate broken insulator—fast.

What's the secret? *Tempering*, a Kimble development in glass insulators that adds a new element to the many natural virtues of glass insulators. Kimble insulators are more than strong enough to meet the severe tests required.

Why not see how *tempered* glass can cut your line maintenance costs. Write for descriptive folder that gives complete details. Address: Kimble Insulator Division, Owens-Illinois, Dept. EW-4, Box 1035, Toledo 1, Ohio.

KIMBLE INSULATORS
AN (O) PRODUCT

OWENS-ILLINOIS
GENERAL OFFICES · TOLEDO 1, OHIO

For 50 Years....

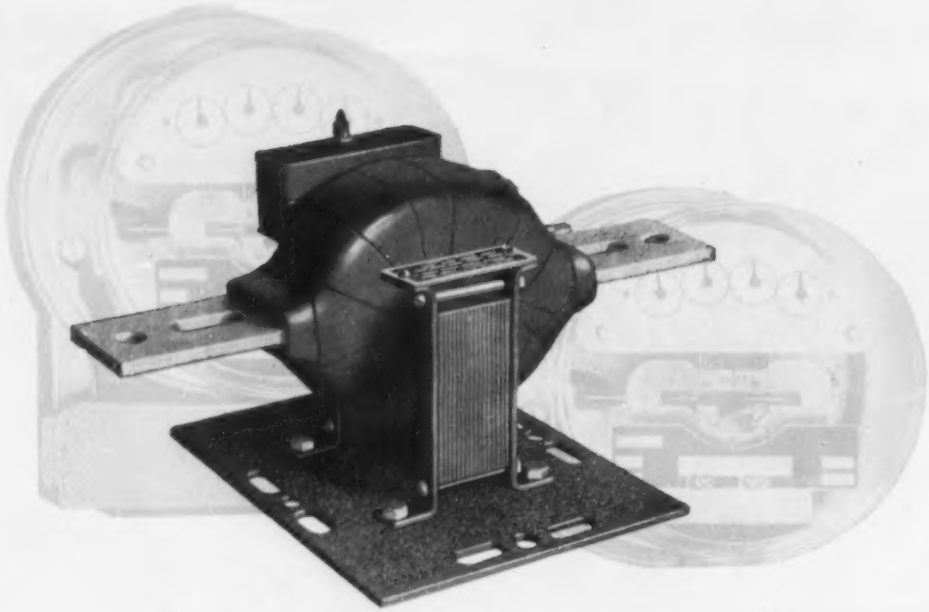
THE WORLD'S MOST POPULAR SAFETY SWITCHES

COMPARE... LINE FOR LINE AND FEATURE FOR FEATURE

THEY COST NO MORE... WHY SETTLE FOR LESS?

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY



Meters that tell the truth ...

DEPEND ON ACCURATE INSTRUMENT TRANSFORMERS

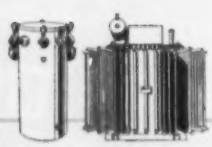
...and accuracy is the watchword at The Standard Transformer Company, where Current, Potential and Metering transformers are built to meet the highest NEMA, AIEE and EEI requirements.

Most economical to use . . . type NAS current transformer (shown above) enables users to stock only a few sizes to cover the entire field of low voltage measurement. This is just one of the complete line of instrument transformers that are "Standard-built" to save you money.

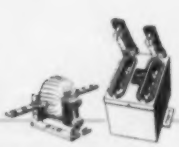
Write for BULLETIN S-501-B ... It's New

Packed with technical information on Current, Potential and Metering transformers, a 32-page bulletin complete with detailed drawings, accuracy limits, ratio and phase angle curves is ready for you. Every type of instrument transformer produced by The Standard Transformer Company is illustrated and described fully. You can have Bulletin S-501-B on your desk by merely writing for it today.

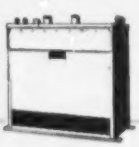
Transformers
FOR EVERY APPLICATION



Liquid filled (sizes up to 10,000 KVA and 72 KV inc.)

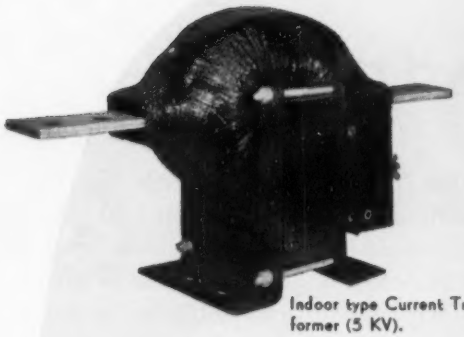


Instrument transformers (for use on circuits up to 72,000 volts, inc.)

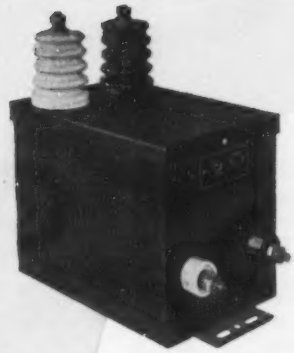


Dry type (up to 1000 KVA and max. voltage ratings of 4800.)

Control transformers (compound filled or open type.)



Indoor type Current Transformer (5 KV).



Indoor type unfused Potential Transformer 200 VA, 2400/120 volts, 60 KV FW impulse level.

Indoor type Potential Transformer with Current limiting fuses, 200 VA, 2400/120 volts, 45 KV FW impulse level.

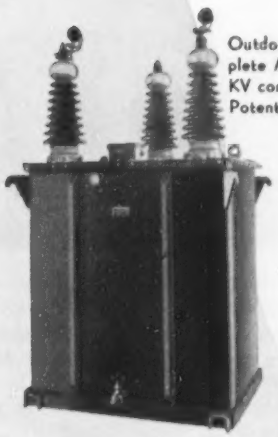
Standard

TRADE MARK ®

CURRENT, POTENTIAL AND METERING TRANSFORMERS

. . . Indoor and Outdoor Current and Potential Transformers . . . Metering Sets . . . Instrument Transformers for Special Applications.

Outdoor type, OISC Potential Transformer for 34.5 KV service.



Outdoor type, OISC complete Metering set for 69 KV containing Current and Potential elements.

Outdoor type, OISC Current Transformer for 46 KV service.

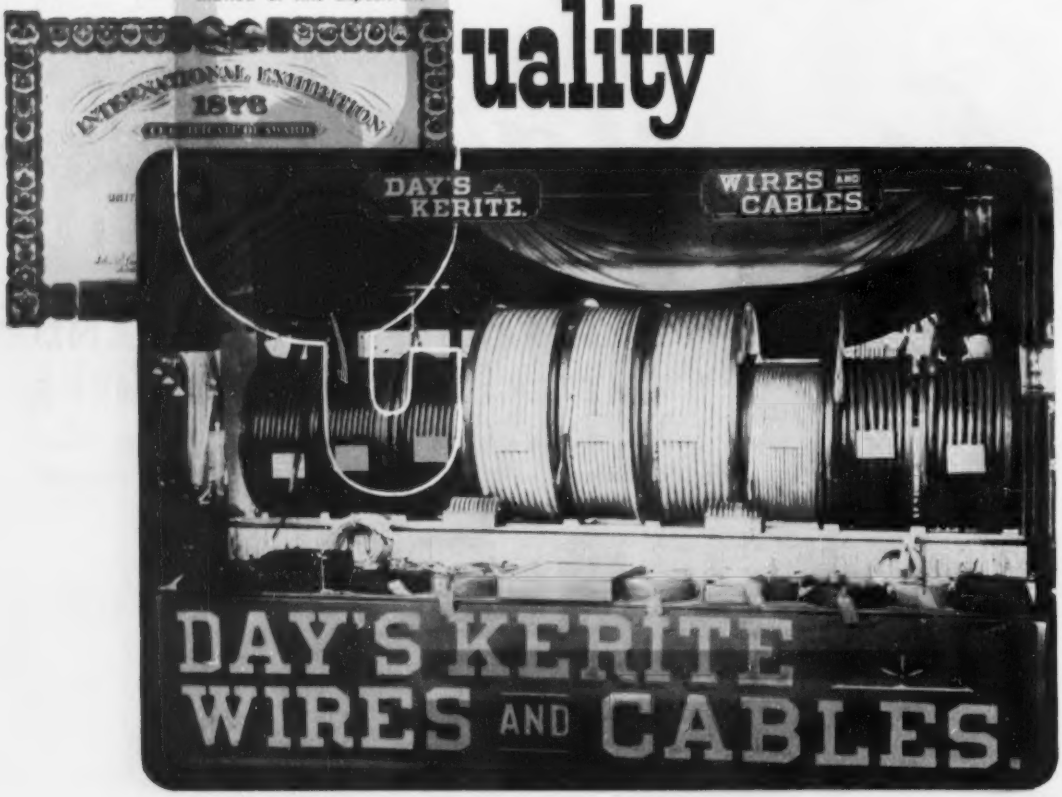
The Standard Transformer Co.

WARREN, OHIO

REPRESENTATIVES IN PRINCIPAL CITIES

The Kerite insulated cable and wire exhibited at the International Centennial Exposition of 1876, received a certificate of award from the United States Centennial Commission, dated September 27, 1876. It is interesting to note that the telephone and multiple telegraph of Dr. Alexander Graham Bell were also exhibited at this exposition.

uality



The quality of Kerite insulation had received world-wide recognition as early as 1876 and has been reflected in its enduring performance under the most adverse conditions. There is only one grade of Kerite insulation—the best.

The value and service life of a product can be no greater than the integrity and craftsmanship of its maker.

KERITE CABLE

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco; 3901 San Fernando Rd., Glendale 4, Calif.; 31 St. James Ave., Boston

Research by the Electric Utilities

Should electric utilities spend $7 million annually for basic research? Dr J. E. Hobson, director, Stanford Research Institute, and Dr W. A. Lewis, dean of the Graduate School, Illinois Institute of Technology, are proposing this idea in a speech being delivered at important meetings over the country.

To justify this huge expenditure for basic research by electric utilities, these men point out that it would represent the same percentage of sales of utilities as that expended by industrial companies. They point out that Bell Telephone Laboratories spends $16.5 million annually for fundamental research. Hobson and Lewis also point to the railroads which, through the Association of American Railroads, have a current research budget of approximately $1 million.

Further proof of the need for basic research is presented by a claim that the electric utility industry "has depended on European discoveries and technology for many of its developments, not only for the more fundamental and basic principles but also for certain equipment developments." They charge the utilities with failure to develop the industrial and economic levels of the areas they serve. It is claimed that "the telephone industry and the railroads have been more enterprising and successful in obtaining recognition of regulatory bodies of research expenditures as appropriate operating charges."

As "much of the research and development effort now made by the electric utility industry is for marginal improvements in efficiency of equipment and plants, with expectation of immediate return," Hobson and Lewis believe the industry's activities at present to be insufficient.

The Hobson-Lewis proposal envisions a program of research in a central laboratory with a staff of 600 to 700 people with 300 or more having professional training. The projects would include investigations of insulating, conducting, dielectric and structural materials; switching; and energy conversion, storage, and transmission.

Finally, Hobson and Lewis have suggested that one of the current needs of the industry is a comprehensive survey to assemble data on the research now in progress.

We are very skeptical of some of the charges leveled against the electric utilities. We also doubt that it is practical or desirable for the utilities to spend $7 million annually for basic research as differentiated from equipment research. But we do agree that a survey of the research activities of the utilities now in progress would be helpful.

The electric utilities have been contributing to and participating in basic as well as equipment research for many years. In addition to this they have carried on projects individually and jointly covering a wide variety of fields.

As an answer to Hobson and Lewis and as a means of informing the public and themselves, it would be highly desirable for the utilities to make a survey of these research activities. Electrical World offers its full cooperation in bringing together and publishing a record of the research activities of the electric utilities.

All a Matter of Principle!

When Bob Moses, chairman of the Power Authority of New York State, appeared before the Senate Public Works Committee (EW, April 12 p 19) in support of the Case Bill, he caused some surprise. The Case Bill permits the Federal Power Commission to pick the developer of the Niagara project. More logically Moses was expected to support the Ives Bill which directs the FPC to license the state authority.

In explaining his stand Moses said it was a matter of principle and that he preferred to take his chances that the FPC would support the state authority plan on its merits.

No one has the right to say that he isn't sincere. But those who know him as a veteran of some 20 years in New York City politics are bound to be suspicious of this noble gesture. They have been wondering if there isn't a bit of trickery or double talk involved. Perhaps this is the answer:

"In issuing . . . licenses . . . the Commission (FPC) shall give preference to applications therefor by States and municipalities, provided the plans for the same are deemed by the Commission equally well adapted, or shall within a reasonable time to be fixed by the Commission be made equally well adapted, to conserve and utilize in the public interest the water resources of the region."

This extract from Section 7 of the Federal Power Act of 1935 is obviously why Bob Moses is so willing to take a chance. The Federal Power Commission has no alternative under the act. It is practically bound to give New York State a preference on development of Niagara. So Ives Bill or Case Bill, Moses can't lose.

Science Teachers Need Encouragement

The secondary school science teacher is decreasing in number so rapidly that he may soon be classified as a "vanishing American." In 1953, there were about 50% fewer college graduates prepared to teach science than in 1950. What makes the situation even more alarming is the belief that fewer than half will teach for more than a short period if they should teach at all. Many female teachers will be lost through marriage. Many males will be led astray by service with the armed forces.

Aware of the criticalness of the situation, Harvard University invited 23 prominent educators to attend last summer a Conference on Nationwide Problems of Science Teaching in the Secondary Schools. The conference amassed considerable data on the problem but no sure solution.

As might be expected, the primary dissatisfaction of the science teacher is low pay. Relatively teachers' salaries have been dropping. In 1938, teachers were in the top third of the income groups of the country. In 1948, they were in the bottom third. With industry, business, and the government paying much higher beginning salaries and offering still higher potential salaries, many trained to teach science never bother to start teaching. Of those who start many are lured away.

The second cause for dissatisfaction is overwork. A teacher doesn't merely teach. He must serve as a student counsellor, supervise study halls, coach, sponsor student organizations, attend faculty and department meetings, and make out various reports. As the report on the Harvard conference says, "One is tempted to ask when does the science teacher find time to teach?"

Knowing these dissatisfactions of the science teacher, what is industry which profits indirectly from their labors going to do? What can it do? For one thing industry and its executives can take a much greater interest in the schools in their local areas. They may be able to work with school authorities on their problems. As big taxpayers they are in an appropriate position to work for higher salaries. They might also offer the science teacher summer employment. This would raise his annual salary to a point where he may be willing to stay in the teaching profession. If something isn't done, industry may find its supply of engineers choked off at its very source.

Transmission and Atomic Power

Long distances of electric transmission are being contemplated to bring the energy of some of the world's remote energy resources to the population centers. Thus Italy is looking longingly at the hydros of Yugoslavia and dreaming of a cable across the Adriatic. The French would like to have cables across the Mediterranean to bring in solar or hydro power from the Sahara and North Africa. Iceland has more hydro and geo-thermal power than it can probably use but to export it would require 500 miles of submarine cable. India's and Africa's hydro resources are fully as remote from population centers.

It is conceivable that direct current could outprove alternating current for some of the longest transmissions. For that reason the Swedish dc cable to the Island of Gottland will be watched with a critical eye.

Of course, one factor that might puncture some of these transmission dreams is the proffered availability of nuclear fuels from the U.S.A. stockpile. Once atomic power has proven its physical feasibility, it will have its best chance to demonstrate its economic feasibility in just such places where power resources are at great distances from the populated areas. In this respect the new fuel may be a more potent alternative to transmission abroad than in the U.S.A. where it presents no discernible threats at all.

Tell All About the Preference Clause

If the "preference clause" is ever to be removed from the federal law books, the opposition to it must come from those against whom it discriminates. But the average electric company customer in Boston, New York, Chicago, San Francisco, and countless other communities doesn't know about the preference clause. He doesn't know that hidden in every electric bill he pays is a tax payment which is used by the federal government to build power systems and in many cases to subsidize their operation for the primary benefit of preference customers throughout the country. If the taxpayer knew, some federal legislators would have to talk mighty fast to convince him hat the preference clause is for the benefit of the people.

One way for the investor-owned companies to inform their customers about the inequities of the preference clause is to put into their hands "Preference vs Fair Play." This 12-page booklet contains an address by A. J. G. Priest, professor of law, University of Virginia. The text is simple enough for any high school graduate to understand. Copies may be secured from the National Association of Electric Companies, 1200 18th Street, NW, Washington 6, D. C.

THE ELECTRICAL WEEK

The Issue's News Highlights . . . Businessmen display optimism in making their expansion plans for 1954-57, McGraw Hill survey shows. Manufacturing firm's planned capital expenditures for '54 equal, 53's.

Washington State Power Commission's claim to public agency preference for BPA power has aroused a furor in Pacific Northwest.

New England Committee on Atomic Energy holds first meeting, will explore possibility of building nuclear power plant in New England area.

Five private utilities in the Northwest formed a new company, Pacific Northwest Power, to develop hydro on a regional basis. The new utility, headed by Kinsey M. Robinson, president of Washington Water Power, hopes to develop the Bruces Eddy and Penny Cliffs sites on the Clearwater River in Idaho, and has its eye on the John Day site on the Columbia. Beside WWP, companies involved are Montana Power, Pacific P&L, Portland General Electric and Mountain States Power.

In another development, Robinson said WWP is ready to make a new merger offer to Puget Sound P&L "any time they (Puget) can get into a position where they cannot walk out."

Duquesne Light chose the site for the country's first commercial nuclear power plant. Under an agreement with AEC, the plant will be built on the south bank of the Ohio River near Shippingport, Pa., 25 miles northwest of Pittsburgh.

State of Arizona, through Republican Rep John H. Rhodes, introduced a bill to permit the government to sell its power transmission lines in the state to Arizona Power Authority.

Recent findings indicate that power systems of British Electricity Authority and Electricite de France can operate continuously together through a 100 Mw interconnection laid in the English Channel, the Institution of Electrical Engineers was told in London. In sea trials conducted since last July cable was energized at 300-400-kv dc.

National Association of Electric Companies last year spent $547,789 on its activities. The sum was the largest reported to Congress under the lobbying law.

No evidence has turned up that would indicate sabotage in the early-April generator explosions that resulted in the shutdown of Richard L. Hearn Station of Hydro-Electric Power Commission of Ontario. Chairman Robert H. Saunders said: "Our investigations so far incline us against the belief that there was an explosion of hydrogen. It would appear at the moment that the original cause was a mechanical defect."

Off the Washington Wire . . . Republican power policy has stepped up interest in local development of hydro sites. FPC now has license applications pending for 11.4 million kw of hydro capacity—42% above June of last year.

House of Representatives approved a $100 million loan authorization fund for REA for the fiscal year beginning July 1. This is $45 million more than the Eisenhower Administration requested for this purpose. House Appropriations Committee also urged REA to make full use of generation loans if necessary "to assure adequate power to REA co-ops on a reasonable basis."

The House passed and sent to the Senate a bill authorizing expenditure of an additional $16 million for Columbia Basin projects. This is designed to get The Dalles Project in Oregon back on schedule.

REA Chief Ancher Nelsen was offered Gordon Clapp's TVA board job. He turned it down.

Frank L. Weaver of FPC's division of river basins was named special technical advisor to the Hoover Commission task force studying federal power operations.

Detroit Edison-Dow Chemical team studying nuclear power has agreed to lay another $2.3 million on the line for advanced experiments and engineering on a breeder reactor for production of power.

Central Electric Power Cooperative of Linn., Mo., has asked Interior Department to carry out the disputed lease-purchase contract between Central and SPA or explain why it should not carry it out. A district court in Washington has ruled that SPA has authority to the contract.

United Gas Improvement Co of Philadelphia received PUC authorization to increase rates of 32 large industrial power users in its Luzerne County Division an estimated $238,000 a year.

San Diego G&E will begin serving another 2,000 power customers April 30 as the result of purchase of Escondido Mutual Water Distribution system in and around Escondido, Calif.

Largest turbine yet planned for mounting directly on its condenser is the 157 Mw unit of Jersey Central P&L at Sayreville, N. J.

Executive Changes . . . Duke Power Co's four new vice presidents are: E. E. Williams, superintendent of the steam division; David Nabow, chief engineer; Marshall E. Lake, manager, mill power department; and John Paul Lucas, Jr, director of advertising and public relations.

Businessmen Show Optimism in Making

McGraw-Hill Department of Economics survey reveals these main facts about industry's planning for the next three years:

1. A drop in capital expenditures for all industry of about 4% in 1954 from 1953; spending for new plant and equipment by manufacturing industry on about same level in '54 as in '53.

Businessmen are looking beyond the current letdown in sales to new growth in future, results of seventh McGraw-Hill survey of business plans for new plants and equipment indicate.

The survey shows that the manufacturing industry's spending plans for new plants and equipment in 1954 will equal the level for 1953. And although they expect sales to decline 2%, manufacturing firms will increase their plant capacity by about 4%.

Relatively High Spending . . . Industry as a whole—manufacturing, mining, electric and gas utilities, railroads, and other transportation and communications—plans capital expenditures about 4% lower than in 1953, according to the study carried out by the McGraw-Hill Department of Economics. But preliminary plans for 1955-57 indicate that capital spending for all industry will be within $2 billion of the high average for 1950-53.

Amounts to be spent by various segments of industry for new plant and equipment are shown in Table I. Manufacturing industries expect to spend $12.3 billion in '54. This aggregate figure is about the same as for '53. However petroleum, food, machinery, electrical machinery and automobile firms plan to spend more in 1954 than in '53, while chemical, steel, textile, and transportation equipment industries plan to spend less.

Plans Revised . . . High level of capital expenditures now planned by manufacturing industries represents a revision of plans since last fall. At that time a preliminary McGraw-Hill survey showed manufacturers were planning to cut capital expenditures by 8% in 1954. The shift is most striking in case of machinery, automobile, and petroleum companies, according to the latest survey, and in general it is the larger companies that are planning to spend more for plants and equipment this year.

Electric utilities and mining companies among the non-manufacturing industries are planning to increase their capital spending in 1954, while railroads, airlines, and gas utilities expect to spend less.

Over the period 1955-1957, industry has preliminary plans to spend an average of $17.5 billion a year for new plant and equipment, the survey shows. And this figure may be revised upward since businessmen tend to underestimate capital spending for periods longer than a year.

Capacity Will Increase . . . Productive capacity increase planned by manufacturing industry in 1954 is 4% with another 9% by the end of 1957 (Table 2). The survey notes that this rate of expansion is considerably below that of recent years (capacity increase was 7% in '53 and 9% in '52).

Electrical machinery companies and chemical firms will rack up the biggest increases in capacity in 1954-57. Companies that are expanding capacity rapidly are mostly those with new products for consumers like electric appliances or new types of machinery for civilian industry.

Expectation of rising sales is considered by McGraw-Hill economists as the key to industry's plans for continued heavy investment in new plant and equipment. Although a 2% sales decline is expected in 1954, the report notes, average manufacturing company anticipates sales will be up 12% over the 1953 level by 1957.

Companies in electrical machinery chemical, food, and petroleum fields, actually expect to buck the trend of declining sales this year. These firms anticipate increased sales and, with the exception of petroleum, are planning largest increases in capacity.

Business Optimism . . . It is not simply rising sales in the years ahead that is prompting manufacturers to expand their capacity but the aim of individual companies to increase their share of the market. Most companies think their sales will expand faster between 1953-57 than sales of their competitors.

	Capital Expenditures (Millions of Dollars)				
	Actual[1]	Planned	Preliminary Plans		
	1953	1954	1955	1956	1957
Steel	$1,340	$1,139	$831	$866	$820
Machinery	803	869	748	682	686
Electrical Machinery	481	553	359	348	310
Automobiles	1,000[2]	1,290	1,045	851	710
Transport Equipment (including aircraft)	168[2]	143	80	24	20
Food	818	865	690	641	607
Chemicals	1,559	1,379	1,216	1,342	1,476
Petroleum[3]	2,762	2,983	2,804	2,744	2,625
Textiles	351	317	341	329	334
Other Manufacturing	2,994	2,764	2,311	2,268	2,368
All Manufacturing	12,276	12,302	10,425	10,095	9,956
Mining	1,011	1,102	1,003	672	661
Railroads	1,312	1,010	949	990	970
Electric & Gas Utilities[4]	4,548	4,366	3,755	3,536	3,536
Other Transportation and Communications	3,158	2,719	2,072	1,921	1,904
All Industry	22,305	21,499	18,204	17,214	17,027

[1]United States Department of Commerce
[2]McGraw-Hill Department of Economics
[3]Covers only companies engaged primarily in refining
[4]Electrical World, American Gas Association

Expansion Plans for 1954-7

2. Increase of 4% in productive capacity by manufacturing firms in 1954 and a further boost of 9% by end of 1957.

Expansion of Capacity in Manufacturing Industry

	Index of Industrial Capacity (1939=100) Planned			Capacity—% Increase		
	1953	1954	1957	1952-3	1953-54	1954-57
Steel	147	150	153	5%	2%	2%
Machinery	325	338	368	7	4	9
Electrical Machinery	452	493	562	13	9	14
Automobiles	202	210	221	3	4	5
Transport Equipment (including aircraft)	495	530	546	17	7	3
Food	162	172	184	3	6	7
Chemicals	393	421	514	10	7	22
Petroleum Refining	208	216	225	7	4	4
Other Manufacturing	157	162	178	6	3	10
All Manufacturing	218	227	247	7	4	9

3. Greater emphasis on replacement and modernization as against expansion.

Expansion vs Modernization
(Per cent of capital expenditures)

	1953		1954		1955-57	
	Expansion	Modernization	Expansion	Modernization	Expansion	Modernization
Steel	48%	52%	16%	84%	14%	86%
Machinery	55	45	53	47	45	55
Electrical Machinery	60	40	61	39	38	62
Automobiles	35	65	36	64	21	79
Transport Equipment (including aircraft)	57	43	24	76	8	92
Food	41	59	37	63	30	70
Chemicals	70	30	66	34	67	33
Petroleum	46	54	47	53	36	64
Textiles	10	90	10	90	7	93
Other Manufacturing	45	55	42	58	47	53
All Manufacturing	48	52	43	57	39	61

All this adds up to more and tougher competition. One indication of this, says the survey, is the division of capital spending between expansion and replacement and modernization (Table 3). Greater emphasis in recent years has been placed on modernization or replacement of older plants than on new additions and this trend will be continued. Reason for this is that modernization and replacement mean cost cutting. Last year manufacturing companies spent 48% of their capital expenditures on expansion, 52% for replacement and modernization. This year 57% is going for replacement and modernization. In the 1955-57 period modernization is expected to claim 61% of capital expenditures.

Other major points in the McGraw-Hill survey are these:

1. Manufacturing companies may adjust—either up or down—capital spending plans if business conditions change. Under ideal conditions in 1954, manufacturing industry as a whole might raise its investment program 15%; under bad conditions the program might be cut in half. For 1955-57 capital spending is about half way between industry's maximum and minimum estimates, with a little more room for increases than decreases.

2. Ninety per cent of the manufacturing companies participating in the survey report they usually reinvest all of their depreciation allowances in new plant and equipment, and 55% said if depreciation allowances were increased they would spend more for this purpose.

3. Electrical machinery companies expect to spend nearly three-quarters as much for research as for new plants and equipment in 1954. Chemical and electrical machinery companies (which expect greatest sales growth between 1953-57) plan to spend most for research in relation to sales—3%.

Case Bill Backed

Budget Bureau endorses measure leaving decision on Niagara power development to FPC

The Eisenhower Administration has teamed up with the New York State Power Authority in support of the Case bill for development of additional power at Niagara.

Bureau of the Budget, speaking for the Administration, endorsed Case bill in a recent letter to Senate Public Works Committee which is considering Niagara power development.

This again puts the White House on record against private company development of approximately 1.1 million kw of power at Niagara. The House overwhelmingly voted for private development last year.

The Case bill, introduced by Sen. Francis Case (R-S. D.) favors public development of Niagara power—which is what the State Power Authority is after. The bill would accomplish its purpose in this way:

Congress would simply turn over the Niagara decision to Federal Power Commission with no instructions. However, under the Federal Power Act the FPC must accord priority consideration to applications of state and municipal bodies. This would give the State Power Authority the advantage it is seeking to capture the license for Niagara development.

In the brief letter to the committee, the Budget Bureau said it believed FPC could best weigh the complicated and different proposals for Niagara development.

BPA Challenged by Washington State

- **Power Commission appointed by Governor Langlie asserts it has 'public agency preference' to BPA power**

- **Oregon newspapers charge power grab; Governor asserts he believes in regional development of area's hydro**

Washington State Power Commission, the power baby of the Pacific Northwest, has begun to cut some teeth. The commission announced it holds "public agency preference status" and intends to exercise the prerogatives that go with that status.

In a letter to Bonneville Power Administration it staked a claim on Columbia River power marketed by the federal agency and indicated its interest in building steam plants to firm up the region's seasonal and interruptible power.

The Reaction

Reaction to the announcements by the commission and statements backing it up by Arthur B. Langlie, Washington's Republican governor, was prompt and widespread. Neighboring Oregon expressed fears for its share of low-cost federal energy; private utilities in the region hinted they were worried that recently concluded BPA contracts may be meaningless. A shadow fell on efforts to establish regional organizations for "local interest" river resource development within the Eisenhower "partnership" concept. And BPA Chief William A. Pearl went off to Washington D. C. to confer with his bosses at Interior.

(The problem posed by WSPC bobbed up at the Northwest Public Power Association Meeting in Tacoma. There WSPC Managing Director J. Frank Ward went on the defensive. See Page 226.)

On Partnership . . . One conclusion seems to have emerged: Any Columbia Basin Interstate Compact Commission is foredoomed if member states begin wrangling over power shares and laying claim to project sites without regard for other members. Governor Langlie himself took this for the theme of a recent press interview.

"I don't feel there is any real conflict of interest among us," he said. "We're all trying to arrive at a minimum outlay for a maximum development before we have a power shortage.

"We've got to hang together if we're not going to wind up with the federal government taking over."

Langlie made his statement after Pearl announced in Washington D. C. that Interior Solicitor Clarence Davis was looking into legal aspects of WSPC's claim to public agency preference status.

Noting that Langlie had been quoted in Electrical World as saying that Washington State might someday try to acquire federal dams within its borders (EW, April 5, p 87), Pearl said he considered it his responsibility to "protect the Bonneville System."

WSPC plans, he said, indicate a producer-wholesaler role rather than a distribution role, and this casts legal doubts on the commission's claims of preference under the federal Bonneville Act.

"They expect to make money," he said, "and it would be federal money."

Langlie's Reply

Later the same day, Langlie replied that the quotes attributed to him were out of context and said his real view was that the U. S. dams "ought to belong to the people of the Northwest when the government gets its money back."

"I also said some time ago," he continued, "that if the federal government is not going to keep up to schedule on Chief Joseph, Washington would be glad to take over and finish it by issuance of revenue bonds. I have no idea the government would want to do that . . ."

The governor declared WSPC intentions were perfectly honorable in so far as neighboring states are concerned. In answer to charges by Oregon newspapers that Washington State was attempting a power grab, he said:

"We would certainly wind up with enough trouble all over the Northwest so that it would seem quite obvious no one is going to get away with it.

"This river (Columbia) is involved with all the Northwest states and British Columbia. We must have mutual confidence or we're doomed to failure."

Langlie was trying to placate criticism arising from Oregon newspaper editorials and jibes by Oregon Democrats who hope to make federal power policy a major 1954 campaign issue.

Controversial Claim

Managing Director Ward claimed preference for the WSPC in a letter sent to Pearl on March 11:

"In order to establish an order of priority of request, this letter may be considered a request by the WSPC on a long term basis for all the firm seasonal energy now available and to become available to the Bonneville Power Administration for sale from the federal basin power developments, together with non-firm seasonal energy resulting from greater than average stream flows, and together with such energy of other character available both seasonal and throughout the year which might be made available to the WSPC for resale.

"Specifically, the WSPC is considering the manner in which some of the energy might be combined with the output of steam generating energy sources to increase the firm power capability of the area under such load factor as would fit the requirements of utilities in the state or which might meet the high load factor demands of industries which would be served through utility systems.

"In order to arrive at an analysis with regard to feasibility we must know that both these classes of power can be available to the WSPC, the quantity so available, both in minimum and more than minimum water conditions, and the price at which such energy can be made available."

Pearl replied for BPA on March 22:

"1. The administration is not in a position to give you the reservation

you request until such time as you are able to make a firm agreement with the administration for the purchase of such power.

"I can't see how Washington is going to grab anything but higher cost projects that would have to be integrated into the system to make them economically feasible.

"We're certainly not trying to wreck a (regional) program we've spent five or six years to build."

"2. We will send you a summary of the amounts of energy available when our studies of non-firm power supplies are complete.

"3. While we are willing to consider the matter, we are not in a position to negotiate a price for non-firm energy until we have a somewhat more definite proposition from you. In particular we need to know the grade of interruptible that you would be willing to accept."

The commission's managing director minced no words in his March 30 response:

"Inasmuch as the Washington State Power Commission does intend to negotiate a firm contract with the Bonneville Power Administration for the kinds of power referred to on some basis mutually to be agreed upon, our letter was written to establish the priority of our request for that power as a 'public agency.' Otherwise the Administration might commit that power to others while negotiations are pending between the Administration and the Washington State Power Commission as a 'public agency' entitled to benefits of the preference clause.

"The WSPC is in a position to agree to purchase non-firm power from the administration and contemplates doing so as soon as you supply the information requested and as soon as you are in position with that information in hand, to negotiate such an agreement."

Authority Adds to Staff

New York State Power Authority has added following men to its staff at a newly established office at 270 Broadway, New York: Col W. S. Chapin, consulting engineer of Triborough Bridge & Tunnel Authority, as general manager and secretary; J. B. McMorran, chief engineer of State Department of Public Works, as chief engineer, and T. F. Moore, Jr, Deputy State Industrial Commissioner, as counsel.

ATOMIC POWER PLANTS like the model under scrutiny here will be a major interest of a New England committee of which these men are members. Left to right, VP William Webster, New England Electric System; Summer Pike, former AEC Chairman; Gov John Lodge of Connecticut, chairman of New England Governors' Conference; and Dr Karl T. Compton, MIT

New England Nuclear Plant . . .

. . . may develop from studies to be made by six-state Governors' Conference committee. Dr Karl Compton elected chairman

It is "very definitely a possibility" that a combined venture may be undertaken in New England to develop a nuclear reactor for commercial power purposes, Dr Karl T. Compton, chairman of the corporation of Massachusetts Institute of Technology, said last week.

Dr Compton spoke in Hartford, Conn., at the first meeting of the New England Committee on Atomic Energy, of which he was elected chairman. The committee was appointed by the New England Governors' Conference.

The group, he said, would explore the possibility of such a venture and report to the governors by the end of the year. It could not officially sponsor a joint organization or corporation for producing nuclear power, he added, but would lend encouragement in getting it established.

This was in line with remarks made by Gov John Lodge of Connecticut, chairman of the Governors' Conference, in keynoting the committee's meeting. "My interest," he said, "derives from the fact that as a public man and as spokesman for the governors of the six states of our historic region, I am convinced that, at this stage of events, the development of atomic power for peacetime uses requires the encouragement and active assistance of government."

'The Strongest Claim' . . . Dr Compton was asked to comment on a decision by the Atomic Energy Commission to award the contract for the first commercial power reactor to Duquesne Light Co, a Pittsburgh firm. He smiled and said the committee had not discussed the Duquesne contract.

Later, however, he said this: "Of all industrial areas of the country, there seems to us to be better reason to introduce atomic power in this (New England) area than in other areas,

simply because we're rather far removed from other sources of power. We believe New England has the strongest claim on atomic power than any other section."

The Duquesne reactor, while large, still will be a pilot plant, he pointed out. The information gained there, he added, will be of benefit to the whole country, not just the Midwest area.

Alfonso Tammaro, who had just been promoted by AEC to assistant general manager for research and industrial development, told the committee at a luncheon session that it should be able to play a major role in the national atomic energy program. He quoted this recent comment by AEC Commissioner Eugene Zuckert:

"The companies that were outdone by Duquesne on the PWR project will be given other opportunities. We will be hoping for new propositions from private industry as we progress through the experimental stages with our other approaches and reach the stage of full scale development."

Proposal to AEC? . . . Governor Lodge suggested the New England committee might work into the AEC nuclear energy program in this way: The committee would make its study, then make recommendations to the governors. The governors in turn would make recommendations to the AEC, possibly in the way of a proposal for joint action on the part of the New England Conference.

A resolution authorizing Lodge to name the committee was passed by the New England Governors Feb. 8. The group was instructed to make prompt survey and concise report to the Conference concerning:

1. The interests of New England in the development of atomic energy, present and potential, for peaceful purposes, particularly in the field of power generation.

2. The extent and effectiveness of present efforts in this field on the part of the New England state governments, educational institutions, private associations, industrial and business firms and individuals.

3. Measures appropriate for both public and private organizations which would stimulate and enlarge New England's participation in the atomic energy program.

4. Such other matters relating to atomic energy as in the judgment of the committee should be brought to the attention of the Conference.

Changes in Capacity Reported to FPC

PLANT ADDITIONS DURING FEBRUARY

State	Utility	Plant	Fuel	Capacity (Kw)
N. Y.	Niagara Mohawk Power	C. R. Huntley	S	80,000
Mich.	Holland Board of Public Works	J. De Young	S	11,500
Mich.	Corps of Engineers	St. Mary's Falls	H	2,000
Wis.	Dairyland Power Cooperative	Stoneman	S	34,500
Wis.	Wisconsin Power & Light	Rock River	S	60,000
Minn.	Warren Water, Light & Power Department	Warren	IC	1,136
Minn.	Otter Tail Power	Hoot Lake	H	1,000
Iowa	Story City Municipal Electric Utility	Story City	IC	746
Iowa	West Bend Municipal Light Plant	West Bend	IC	984
Kan.	Kansas Gas & Electric	Murry Gill	S	60,000
Kan.	Central Kansas Power	Ross Beach	S	11,500
N. C.	Tennessee Valley Authority	Fontana Dam	H	67,500
S. C.	South Carolina Generating	Urquhart	S	75,000
Tenn.	Tennessee Valley Authority	Kingston	S	135,000
Tenn.	Tennessee Valley Authority	Ft. Patrick Henry	H	18,000
Ala.	Alabama Power	Barry	S	125,000
N. M.	Lea County Electric Cooperative	Lovington	IC	2,250
Wash.	Seattle Department of Lighting	Ross	H	90,000

PLANT RETIREMENTS DURING FEBRUARY

R. I.	Blackstone Valley Gas & Electric	Pawtucket 2	H	400
Mich.	Consumers Power	Centreville	H	150
Minn.	Warren Water, Light & Power Department	Warren	IC	120
Minn.	Otter Tail Power	Hoot Lake	H	1,100
Minn.	Border Counties Power Cooperative	Big Falls	IC	112
Iowa	West Bend Municipal Light Plant	West Bend	IC	73
Ark.	Hope Water & Light Plant	Hope	S	500
N. M.	Kit Carson Electric Cooperative	Taos	IC	195
Ore.	Mountain States Power	Mill City	H	320

H—Hydro, IC—Internal Combustion, S—Steam
United States Capacity as of March 1—Hydro, 22,351,094 kw; Internal Combustion, 2,226,147 kw; Steam, 67,877,859 kw; Total, 92,455,100 kw.

Reactor Debate . . .

. . . being carried on by nuclear experts over best approach to competitive atomic power

Dead serious debate is being carried on over the best approach to competitive atomic power which makes the old copper vs aluminum controversy seem mild by comparison.

In simple terms it is a battle of the nuclear scientists and engineers over which atomic firebox (reactor) is the best bet to produce economical electrical power.

Project Almost Halted . . . At one point in recent months the argument became so heated that the Joint Congressional Committee on Atomic Energy was on the verge of halting, or at least drastically scaling down, the only utility-size nuclear power plant now in the design stage.

The recently announced five-year reactor development program (EW, March 15, p 7) is an attempt to channel research and development into the most promising avenues. While it is a step welcomed by many reactor specialists, it is not expected to silence arguments on merits of various approaches.

After conferring with some 20 of the nation's top reactor experts, the Joint Committee came to this conclusion on the five-year program:

"The proposed program is the subject of controversy not in its concept but in its estimates of scale of effort and priority of (the five) projects. This controversy is the direct result of the natural and desirable optimism of the various project proponents for their own approaches. The most serious criticism which might be leveled at this program is that it overlooks some profitable approaches completely or distorts the level of effort unduly. No such criticism appears warranted."

Reactors Rated . . . In this same report, the committee went into this controversy far enough to get the experts' ideas as to the relative promise of the various reactor approaches. Result of this survey was a listing of the projects in order of their ability to compete with conventional power sources:

1. Homogeneous reactor which

would carry the fissionable fuel in an aqueous solution through the firebox. This one is being developed by the Oak Ridge National Laboratory.

2. Fast breeder reactor experiment which is being carried on by the Argonne National Laboratory.

3. Boiling water reactor (EW, April 5, p 89) being developed by Argonne.

4. Sodium-graphite reactor experiment being carried on by North American Aviation Co.

5. Pressurized-water reactor, only utility-size power reactor in the program, being built by Westinghouse Electric Corp. It will be operated by Duquesne Light Co.

The same experts were asked to rate projects by time required to begin large experimental testing.

On that basis, the pressurized water and sodium graphite reactors were classed as "short term" projects meaning they could be ready for large-scale testing in two or three years. The boiling water reactor was classed as "middle term" with the expectation that it would be ready for testing in less than five years. The homogeneous and fast breeder reactors are "long term" projects requiring more than five years for a startup.

Although the committee report did not give the details, a withering fire of criticism was leveled at the $87-million PWR experiment.

The experts argued that too much emphasis was being placed on this approach, which they had voted the least likely to produce competitive power. The subcommittee however decided to reconsider the PWR experiment. This decision came just a few days before AEC was to announce that Duquesne Light was joining up on PWR.

PWR Defended . . . At a closed hearing, AEC officials succeeded in convincing the committee that the PWR project should go ahead.

To do this they assured the Congressmen that "every effort will be made to incorporate into the PWR all promising ideas which will help make it more economic and will not unduly delay its completion."

While the committee upheld the AEC plea, the action has not quieted criticism both within and outside the commission. Some PWR critics jeer that the PWR really means "power without reason" because of the relatively high costs involved. Informed AEC sources say PWR power will cost 12 mills per kwhr.

Blamed in Disaster, Commission Quits

The three-man British Columbia Power Commission and its chief engineer have resigned after being blamed for failing to prevent two major slides which last August nearly buried the $6-million, 25,000-kw Whatshan power project (EW, Nov. 16, p 218).

The report holding the commission responsible was submitted last month to the British Columbia legislature by Justice J. V. Clyne, a one-man Royal Commission set up by Premier W. A. C. Bennett to investigate the disaster.

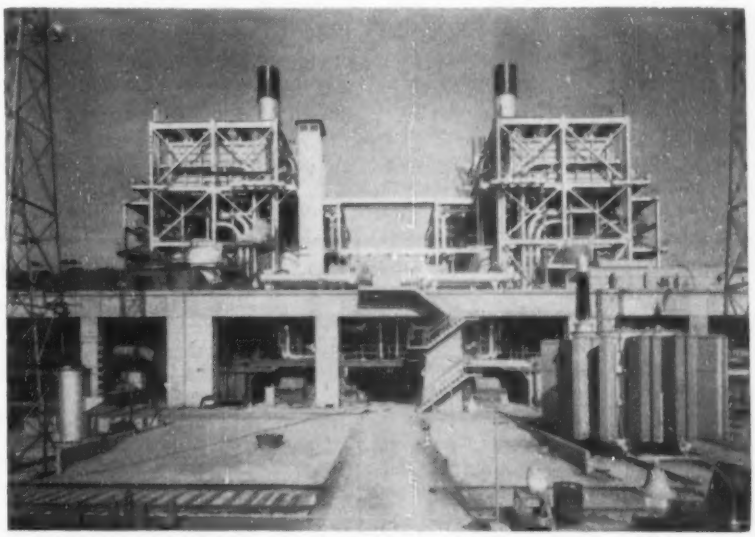
[The first of the two generating units at the Whatshan plant went back into operation on Dec. 4. Rehabilitation work including removal of overburden is continuing. The top story of the superstructure will be completely rebuilt. Officials state it is difficult at this stage to estimate the total cost of repairs but believe the amount roughly will be between $750,000-$1 million.]

Commission members who have resigned were Chairman S. R. Weston, W. W. Foster, and Forrest L. Shaw. Chief engineer was Alfred W. Lash.

New Commissioners . . . A new commission was promptly appointed, including Thomas H. Crosby, former Pacific regional manager, Canadian Westinghouse Co, Ltd., chairman; Dr Hector J. MacLeod, who had been dean of applied sciences, University of British Columbia; and James D. W. Blyth, comptroller in Toronto for Brazilian Traction Power & Light Co.

Justice Clyne found that the old commission had been complacent, despite repeated warnings of danger. He recorded that for 18 months they had been receiving reports of seepage and earth movements at the government-owned project, but failed to take effective steps. The justice also found the chief engineer "negligent in failing to take proper steps to prevent the slides."

Clyne cleared H. G. Acres & Co, engineering consultants, of any blame.



Outdoors Plant Dedicated on West Coast

Most "all outdoors" steam electric station in Los Angeles area, Southern California Edison Co's 250,000-kw Etiwanda Station, was dedicated last week. Photo shows south side of turbine deck with boilers in the background. Boilers, turbines, generators, and heaters stand on a steel and concrete platform open to the sky. Some other equipment is protected merely by an overhead concrete deck. Only the administration building, central control room, and several other areas are enclosed or shielded from the weather.

The $35-million steam plant was designed and built by Stone & Webster Corp in collaboration with Southern California Edison's engineering department. Station contains two 125,000-kw units.

Nuclear Power Generation to Reach

● **AEC predicts nearly 25% of all generation will be nuclear in four decades**

ARCHER E. KNOWLTON
Senior Associate Editor, Electrical World

Practically overnight something impressive has happened to the oft-repeated comment that it could easily be 20 years before the U. S. A. would enjoy commercially practicable power from nuclear fuels. Now not only is it promised that the amount working by 1974 could be one-sixth of the prospective total generating capacity but that it would constitute 25% of the total by 2000 AD. Put in other terms nuclear power will reach 20,000,000 kw by 1974 and 200,000,000 kw by 2000—twice as much as the present 1954 total of 100,000,000.

No Reactor Singled Out . . . These are AEC prognostications and were disclosed at the recent Atomic Industrial Forum in New York in a symposium directed at showing American manufacturers what market they should see ahead for products needed in reactor plants. There is the prospect. How current technical and economic obstacles to success are to be overcome was not predicted. Nor was a particular one of the many types of reactors singled out as the most promising.

Nevertheless the announcement that the Duquesne-Westinghouse reactor will be of the PWR (pressurized water reactor) type does indicate some modicum of technical-economic preference. It may be as long as six years before it can be producing effectively, but by that time it should be the pioneer electric plant powered by uranium fuel. From then on the annual increments and cumulative additions will pile up—according to the chart—at a phenomenal rate.

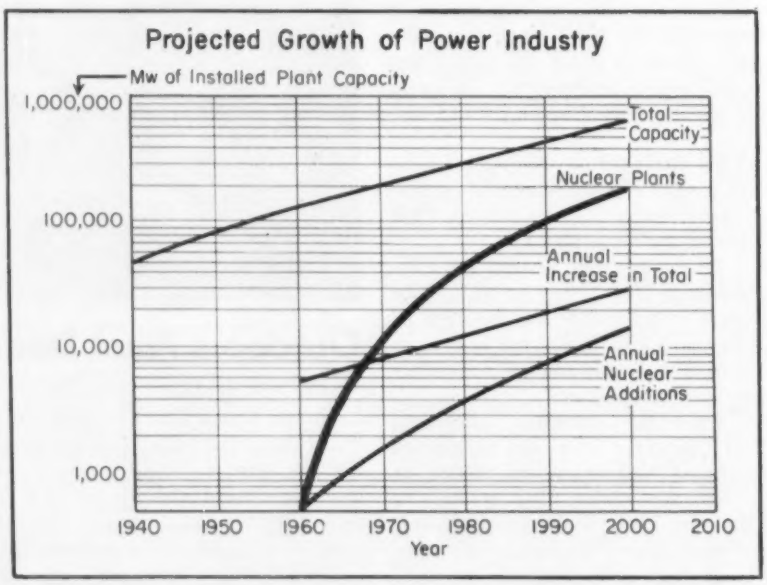
Achievements to Date . . . In view of this sudden stepped-up activity it may be worthwhile to see where the art stands in 1954 and how falteringly it has reached that stage. Certain of the reactors here and abroad have produced sizable amounts of power. The submarine Nautilus will be powered by an 18-20-Mw reactor. An 8,000-hp locomotive is on the drawing boards. And far into the opposite and infinitesimal direction is the virtually simultaneous announcement by Radio Corporation of America and the Philip E. Ohmart Co that they have achieved the direct conversion of radioactive energy into electric current.

Admittedly the picture is a confused one with fast and slow reactors, breeders and converters, single-purpose vs power-plus-plutonium, heavy water and liquid metal coolants, various moderators all competing for coordination and attention. Despite these technical variations the impressive fact is that reactors are producing power so convincingly that prospective capacities are confidently measured in megawatts rather than kilowatts.

First in time among the research reactors was the Chicago natural uranium-graphite unit. Now at Argonne National Laboratory it can be operated continuously at a 2-kw heat output rate and for brief periods at 100 kw. A similar one at Harwell, England, is said to operate at a normal power of 100 kw. In neither case, however, was the heat energy converted to electricity. At Argonne it was dissipated as has been the case at the Hanford plutonium-producing plant which discharges into the Columbia River some 1,500,000 kwhr for each kilogram of plutonium manufactured.

Incidentally it should be remembered that a 100-kw reactor is one producing that much power in Btu of heat but only, say, one-fourth as much in electrical kilowatts generated from the resulting steam.

Of course, the progenitor of all was the Oak Ridge reactor, but it was regarded purely as a production reactor (originally plutonium, later isotopes) with a nominal power rating of 1,000-2,000 kw. The Bepo (British Experimental Pile 0) has been reported to generate up to 6,000 kw, and some of this heat warms the laboratories and other buildings. Canada's Chalk River reactor, recently rebuilt after serious damage, operated at a top of 50 w. Los Alamos



NUCLEAR FUELS are expected to generate 25% of the megawatts of 2000 AD. This 200,000,000-kw total will be more than twice the total installed capacity of all types now on line

200,000,000 Kw by 2000 AD

• Foreign countries active in research and construction of test reactors

had a 10-kw "water-boiler" form of reactor.

Reverting to the calendar sequences the Clinton reactor was spoken of as a 500-kw unit at first and later 1,800 kw. In July 1953 the AEC Arco EBR (experimental breeder reactor) was generating about 170 kw from reactor-produced steam at 400 psi and 550 F at the same time as breeding slightly more nuclear fuel than it was consuming.

Many Foreign Developments . . . Looking at the international picture the Netherlands and Norway have been collaborating for over 3 years in the so-called JEEP project (Joint Establishment for Experimental Pile) at Kjeller, Norway. They are now working on a 5-Mw generator. It employs natural uranium and heavy water for moderator. It is reported to have been built for $72 per kw. Norsk Hydro is supplying the heavy water for the project as well as for other reactor projects in Switzerland, Belgium, France, Great Britain, Italy, Canada, Mexico, Brazil, India, and Australia.

Everybody's Interested . . . Further to show the international ramifications of nuclear energy an informal conference was held at Kjeller in August 1953. Nineteen nations were represented by 100 scientists some of whom had not seen a reactor. Before breaking up, the conference set in motion the formation of an international nuclear energy society. Here then is the skeleton set-up around which could be implemented President Eisenhower's proposals in the United Nations speech of Dec. 8, 1953, to internationalize the atom for peacetime and industrial utilization.

So much for the physical retrospect. The chain of governmental and industrial moves also shows the step-up in tempo since the utility groups first met in 1951 to discuss exploratory studies with AEC. A year later the AEC announced at a Congressional hearing (on Oct. 13, 1952), the criteria for a first commercial atomic energy plant. At this same period General Electric completed the foundation for the "Atom's Apple" sphere to be the 225-ft-diameter protective enclosure for the land-based prototype submarine. Before the end of 1952 Congress had advised AEC that modification of the McMahon Act might well be desirable.

Early in 1953 Chairman Gordon Dean of AEC predicted that the first stationary power plant based on nuclear fuel would be designed during the ensuing year. Shortly thereafter Union Electric Co of Missouri and Monsanto indicated they were interested in building a pilot plant. In March 1953 Edison Electric Institute set up a special atomic committee with Edgar H. Dixon, president of Middle South Utilities, as chairman. The assigned function was to further industry-wide relations.

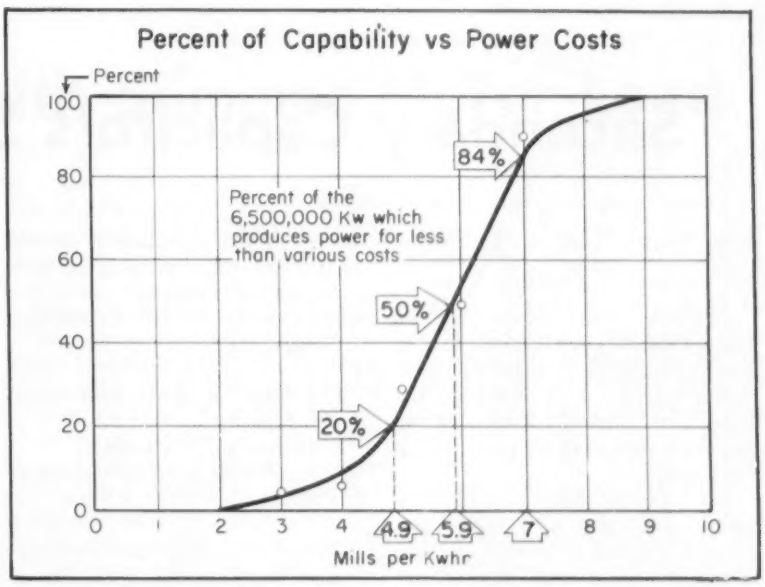
Low-power operation of a 20-Mw reactor at the National Reactor Testing Station at Arco, Idaho, was announced by AEC. It was being developed for propulsion of the Nautilus launched at the submarine base in New London, Conn. late in 1953.

Modifications of the McMahon Act were submitted by AEC in formal recommendations to the Congressional Committee in April 1953.

Two manufacturers rode into the news in May and June 1953. Westinghouse started construction of a manufacturing plant to produce parts for nuclear reactors and their auxiliaries. North American Aviation announced readiness to lay out $10 million to build an 8,000-kw single-purpose (power only) reactor plant.

At this same time AEC released for publication the feasibility reports of the four utility-industrial teams which had been studying nuclear power since 1951. In September these teams were reshuffled to some extent with Duquesne Light, American Gas & Electric and Walter Kidde Nuclear Laboratories joining the activity.

In this period the Atomic Industrial Forum was incorporated and began operations with a conference in the fall, followed by another in March 1954 at which the prognostications that open this article were made.



TO COMPETE with prevailing fuel to the point of capturing half the generation, nuclear fuel will have to beat the 5.9 mills per kwhr average of 26 plants larger than 100,000 kw

SECONDARY CAPACITORS (bank of eight 3-kvar units) release distribution transformer capacity, cut losses, and increase voltage

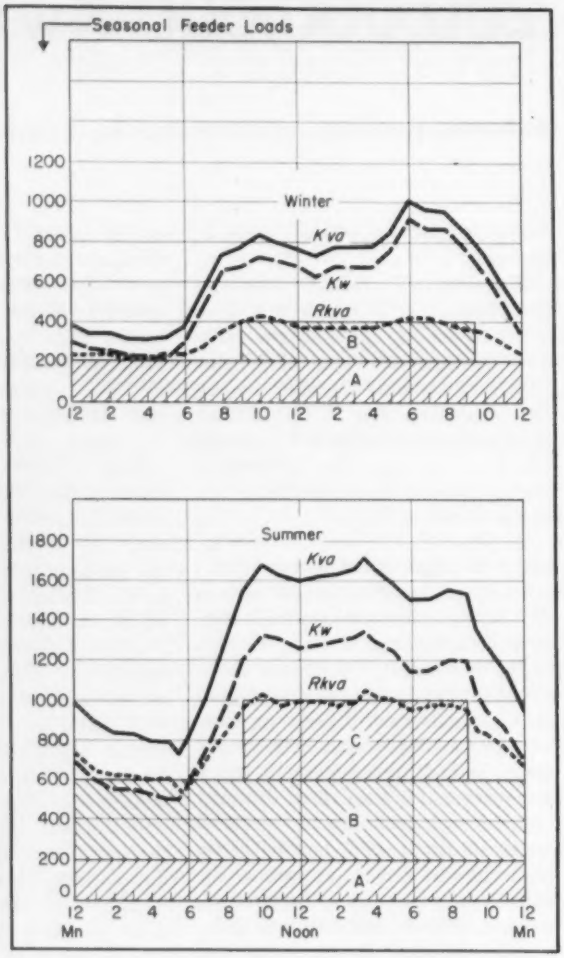


FIG 1—VARS for winter (upper part) and summer (lower part) are plotted from recording meter data taken on January and June days

Secondary Capacitors Show Savings

R. H. BISHOP, Distribution Superintendent, Public Service Co of Oklahoma, Tulsa, Okla.

Operating where warm weather brings a sizable jump in motor load in both residential and commercial areas, Public Service Co of Oklahoma has found it economically feasible to use secondary capacitors for power factor correction.

The savings derived from this usage, according to the company's experience, increase as loadings increase and decline only when transformers are loaded at less than rated capacity.

Although its benefits come in small increments, this application is justified by the fact that it earns up to 30% return on the additional outlay over primary capacitor costs. Its extended advantages are:

1. Release of distribution transformer capacity.
2. Lowering of I^2X losses.
3. An increase in voltage not otherwise obtainable.

Figures in the table, based on transformers being loaded to 100% of rated load, give the percentage return through savings on reduced losses and increased revenue, and the total percent return.

Basic Plan . . . Power factor correction by primary capacitors, now a universal practice, costs less per kvar than capacitors on the secondary side. Their application is easier too. Less study and fewer crew hours go into installing one 300-kvar bank than into placing a hundred 3-kvar units.

Primary banks have another advantage, in as much as they are more easily controlled and are adapted to switching by automatic means such as time, voltage, and temperature con-

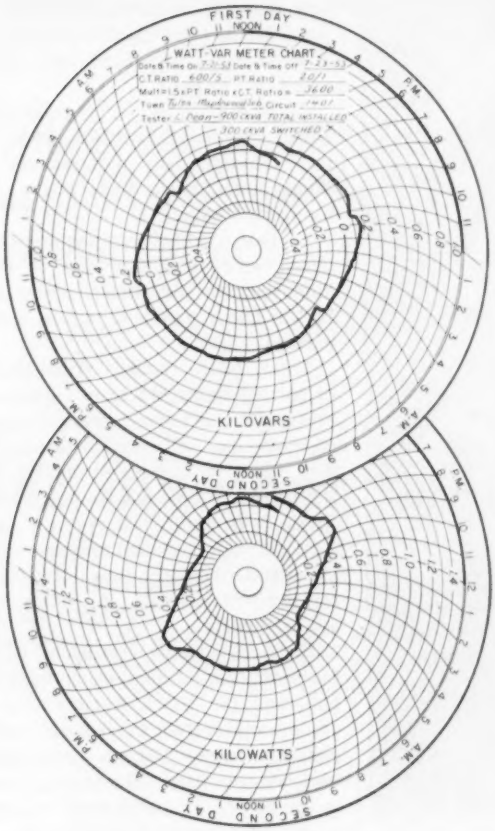


FIG 2—WATT AND VAR CHARTS taken on summer day at substation. Leading vars are below and lagging vars above scale's zero

TEST BLOCKS on all circuits facilitate watt and var data taking essential to capacitor application. The instruments are plugged in

on System with Summer Motor Load

trol. At present, secondary capacitors cannot be switched so that their number on one feeder is restricted to the annual var requirements.

In the secondary application the capacitors are as near the load as possible. Consequently, each section of a feeder is brought to the point of junction and each feeder to the substation at very nearly unity power factor.

I^2X losses in substations and transmission lines are compensated for by installations of large banks of capacitors in substations where transmission and distribution come together. These banks are easily controlled and permit the system to be operated at a very high power factor without endangering in the least system stability.

Summer Peak Load . . . In the Southwest peak load occurs in the summer. This peaking is a consequence of the expanding use of air conditioning which comes on the distribution system when refrigerator and freezer load is also at a maximum. All types of cooling equipment have a poor power factor. Their application gives a much greater boost to the var load than to the watt load. This fact is demonstrated in Fig. 2, charts that were plotted from data taken on a combination commercial and residential feeder in July at a substation.

Data for lower part of Fig. 1 were recorded on a warm day; those for the upper part on a winter day. Comparison of the charts shows that the minimum kilovars jumped from 200 on the winter day to about 600 on the summer day, and maximum kilovars changed from slightly more than 400 to well over 1,000. Maximum demand changed from 900 to 1,300 kw. Thus minimum kilovars tripled, maximum increased 150%, maximum kilowatt demands increased only 44%.

EXPERIMENTAL CONTROL STATION, shown above, was installed on a pole of the distribution system. Station combines time and temperature controls for system's primary capacitors

Percent Return on Investment in Secondary Capacitors

(Based on 100% Transformer Loading)

	Transformer Sizes			
Capacitors	5 Kva	10 Kva	15 Kva	25 Kva
3 Ckva	21.5	18.5	16.7	12.9
6 Ckva		14.2	14.9	12.3
9 Ckva			12.2	11.4
12 Ckva				10.3
15 Ckva				9.1

	Percent Return Due to Increased Revenue			
Capacitors	5 Kva	10 Kva	15 Kva	25 Kva
3 Ckva	8.6	11.9	12.1	16.6
6 Ckva		12.3	12.0	17.0
9 Ckva			12.2	17.2
12 Ckva				17.3
15 Ckva				17.4

	Percent Return—Total			
Capacitors	5 Kva	10 Kva	15 Kva	25 Kva
3 Ckva	30.1	30.4	28.8	29.5
6 Ckva		26.5	26.9	29.3
9 Ckva			24.4	28.6
12 Ckva				27.6
15 Ckva				26.5

Blocking Var Needs . . . Through such charts Public Service Co of Oklahoma saw that var requirements could be presented as three blocks, such as:

1. That part present all year, designated "A" in Fig 1.

2. That part of var requirements which, when added to "A", makes up the minimum daily requirements in the summer, designated "B" in the lower part on Fig 1.

3. That part of var requirements which varies with the time of day, both summer and winter, designated "B" in upper part and "C" in lower part on Fig 1.

These blocks enable visualization of corresponding blocks of capacitors being switched to meet changing load requirements. Capacitors associated with Block A are the permanent installations. Capacitors co-related to Block B, in lower part of Fig 1, are switched seasonally and remain on for the summer season. Block C capacitors are switched daily and follow the var load curve.

Practically, Block A capacitors are the permanent installations on the system, and the Block B capacitors a compromise between secondary and primary power factor correction, switched seasonally. The Block C load is handled by switching banks of primary capacitors with time clocks.

Until secondary capacitors can be switched automatically, this method offers the most practical solution to a problem becoming increasingly knotty.

Obtaining Data . . . For obtaining data such as are required for plotting Fig 1, Oklahoma PS has equipped all circuits with test blocks. These blocks are wired to accept a plug which, in turn, is wired to a watt-var set like that illustrated. Connections for a recording test can be made in a few minutes, and even less skilled operators can perform a test which might otherwise require greater knowledge.

Fig 2 is a sample of the type of charts obtained.

Tests are made seasonally and at times of changing load conditions. Once the pattern has been established, analysis of the charts and corrections either in the quantity of capacitors or in time is relatively easy. When such corrections become routine, the maximum capability of each feeder in the system is obtained. This naturally contributes greatly to system efficiency and makes for a reduction in operating costs.

Watthour Meter Phantom Load Test Potential Circuit . . .

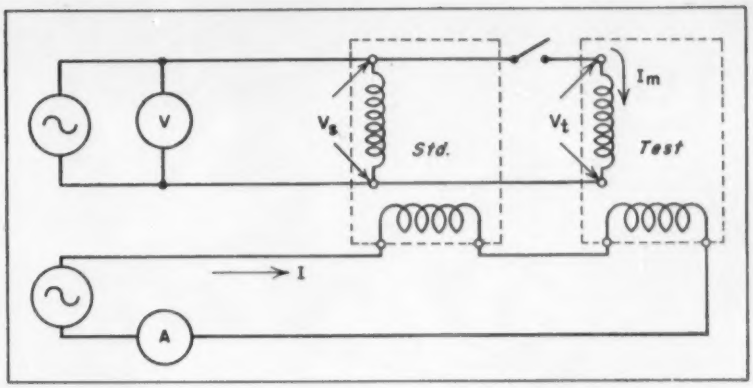


FIG 1—WHEN CONNECTIONS are as diagrammed, potential leads from the standard to the test meter are in effect part of the test meter and registration is that of meter with leads

Has Inherent Lead Resistance Error

FRANCIS L. HERMACH

THOMAS L. ZAPF

National Bureau of Standards, U. S. Department of Commerce, Washington 25, D. C.

The "phantom" load method of testing watthour meters has implicit in it a source of significant errors not generally recognized, although the method continues in common usage. Errors may be introduced by the resistance of the leads of the potential circuit.

The "phantom" loading method of testing meters employs two separate power sources, one for energizing the current circuit and the other the potential circuit. The popularity of this method lies in the ease with which various loading conditions may be simulated.

When this test method is used, the current coil of the watthour meter under test is connected in series with the current coil of a standard watthour meter or wattmeter and to an adjustable low-voltage ac source. The voltage coil is connected in parallel with the voltage coil of the standard and to a second ac source of the same frequency adjustable in magnitude and in phase with the first source. These sources are generally derived from sine-wave alternators, electronic voltage stabilizers, or directly from a polyphase distribution system.

When the connections are made as diagrammed in Fig 1, the potential leads from the standard to the test meter are in effect a part of the test meter; and the registration as determined from the test is that of the test meter with these leads. If the meter is later used or tested with other leads of different resistance, an error may occur.

This error is usually negligible, but may be significant if several meters are tested in parallel and relays or switches open and close the potential circuits of the watthour meters that are under test.

Negligible at Unity Power Factor . . . Lead resistance errors are more serious in tests of watthour meters than in tests of other instruments. This is so because the impedance of the potential circuit of a watthour meter is much lower (as low as 5 ohms per v). The potential circuit being highly inductive a small lead resistance has almost no effect on the magnitude of the voltage at the meter terminals. Lead resistance, however, may introduce a significant change of phase angle.

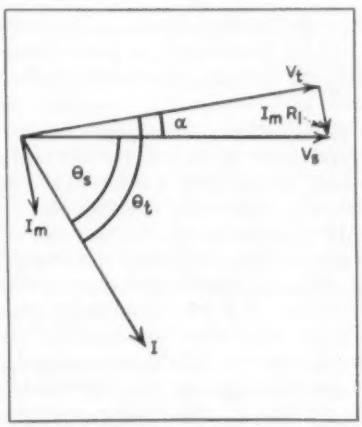


FIG 2—CURRENT, I_m, lags V_t by 90 deg, impedance being an inductive reactance,

As shown in the equations hereafter, the resulting error is negligible at unity power factor. However, the error may be significant at other power factors.

The registration of the meter itself can be calculated to a sufficiently close approximation from the test results when the load power factor, the lead resistance (including the contact resistance of any relays or switches), and the impedance of the potential circuit of the meter are known and when sinusoidal wave forms are assumed.

The registration of the test meter and leads as measured with the standard is

$$\mathscr{R}_m = \frac{KN}{W_s}$$

where K and N are the disk constant and the number of revolutions of the test watthour meter, and W_s is the energy in watthours measured by the standard.

From Fig 1, the energy measured by the standard is

$$W_s = V_s I h \cos \theta_s$$

Therefore

$$\mathscr{R}_m = \frac{KN}{V_s I h \cos \theta_s}$$

where h is the time of test in hours, V_s and I are shown in Fig 1, and θ_s is the

(*Continued on page* 212)

Streamlined Trouble Call Procedure

C. H. HUBER, Engineer, Overhead Construction Department, Commonwealth Edison Co, Chicago

Faster restoration of service during storms was the objective which prompted the Overhead Construction Department of Commonwealth Edison Co to revise its handling of trouble calls. While the revised plan somewhat resembles the former trouble call handling procedure, innovations now expedite the despatching of trouble crews.

Three major changes are:

1. Trouble Call and Maintenance and Repair Order forms were combined as the new Overhead Trouble/Repair Order.

2. All incoming calls are sent to a master sorting desk for screening before being dispatched to the field crews. This eliminates duplication.

3. Zones, based upon the U. S. Government postal zones, divide the city into more practical areas than the former quarter-mile square sections. Most customers calling the company know their postal zone numbers. This obviates the necessity of a clerk looking up and classifying the call by zone. It is much easier to divide calls into 45 zones than into 1,100 quarter-section.

Trouble Call Flow Chart . . . The flow chart for trouble call can best be understood through a description of the work performed.

At the trouble desk forms are removed from the teletype machines, or a hand written form is prepared when the call is received by telephone.

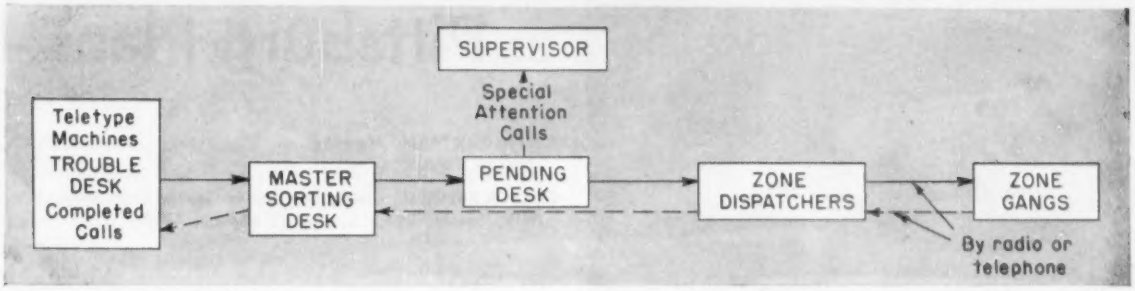
Duplicate calls are eliminated at the master sorting desk which is manned by the most experienced dispatching personnel. If a call is a duplicate, the original and carbon are attached to the carbon copy of the previous call. If the call is a primary one, the carbon copy is filed by zone number, and the original is forwarded to the pending desk.

Trouble orders are sorted at the pending desk by zone number, special emphasis being placed upon the urgency of each call. Waiting calls not yet assigned are given to the zone dispatchers as rapidly as possible.

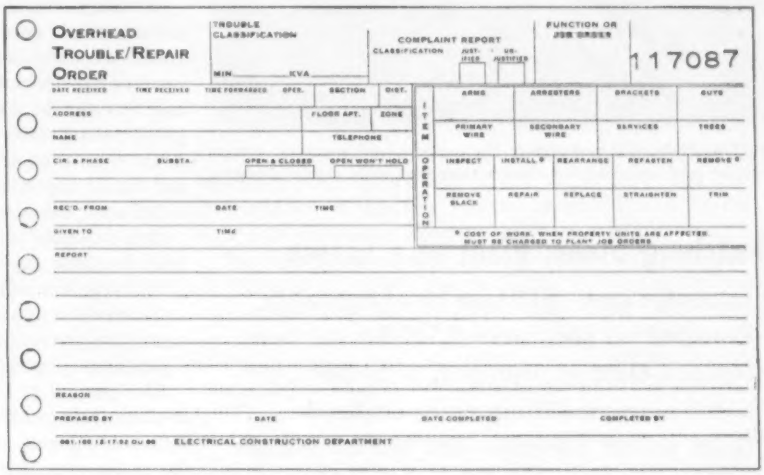
Special Attention Calls . . . When transmission lines, circuits, hospitals, or large customers are involved, the supervisor is notified. He follows up personally on the work progress of these "special attention" or priority calls. All transmission line and circuit troubles are entered on a blackboard described below.

The zone dispatcher relays calls to zone gangs by radio or telephone. When calls are few, one dispatcher handles many zones. As calls increase, zones may be re-allocated as necessary among additional dispatchers.

Zone gangs make temporary or permanent repairs and report the extent of repairs made to the zone dispatcher



Master sorting desk (left) gets incoming calls for screening before they are dispatched to crews in the field. Maps on desk show postal zones by which calls are grouped. Flow chart (above) shows routing of calls recorded on Overhead Trouble/Repair Order


OVERHEAD TROUBLE/REPAIR ORDER

117087

Speeds Restoring Service in Storms

by radio or telephone. The zone dispatcher notes the information received from the zone gang on the original copy.

Master Sorting Desk . . . At the master sorting desk when permanent repairs have been completed, the carbon copy of the trouble form is destroyed, and the original is placed with the other completed calls. When temporary repairs have been made, both copies are retained for reassignment to field crews after the emergency situation has passed. All trouble orders are forwarded to the trouble desk.

The trouble desk handles the details of classifying calls, filing completed calls, routing uncompleted trouble orders to the proper dispatchers, and preparing storm reports when necessary.

Aids to Dispatching . . . In addition to the teletype machines, telephones, and radio equipped trucks, acknowledged as invaluable aids in processing trouble calls, other simple, yet effective, devices are used. Among these are the following:

Zone Map . . . Two zone maps, each showing one half of the City of Chicago are located on the trouble desks. The maps are metal backed and every trouble truck number in Overhead Construction is represented by a magnetic marker.

Under emergency conditions, truck numbers of other types of trucks may be affixed to these markers. By placing the marker in the proper spot on the maps, it is possible to locate the approximate position of any truck. This is particularly advantageous during a storm.

Substation Feeder Map . . . A six-foot map of the city showing substations and feeder cables is mounted on a stand adjacent to the trouble dispatchers' desk to assist them in ascertaining which substation circuits are feeding a particular customer, block, or distribution area.

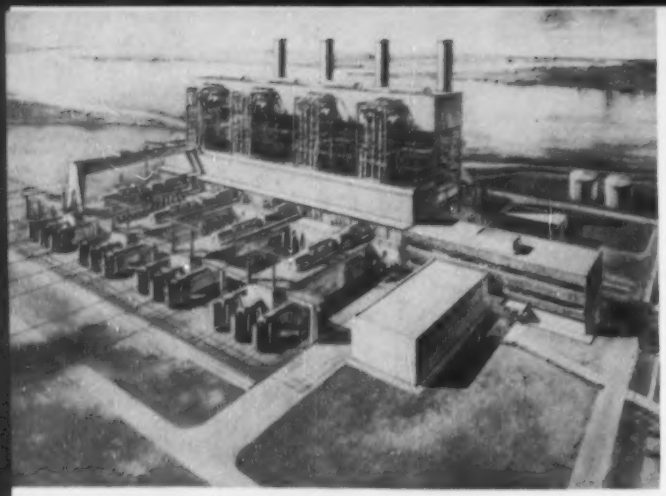
Individual maps of all substation 4-kv circuits are available in loose-leaf book form.

Blackboards . . . A pair of large ruled blackboards are placed where they may be seen by all trouble dispatchers. Spaces are provided for entering the number of the circuit or lines in trouble.

Other pertinent information, such as boundaries of the area served, time of outage, and time of restoration may be included.

These blackboards aid in spotting duplicate calls.

The improved trouble handling procedure has been employed several times during recent storms. Under actual emergency conditions the new Commonwealth trouble procedure has proved very workable and efficient. Service restoration has been speeded.



OUTDOOR DESIGN of Pittsburg Plant calls for all apparatus except turbine head ends and some steam equipment to be placed outdoors

Pittsburg Steam Plant at a Glance

- Estimated cost—$120 per kw of capability
- Expected net heat rate—9,550 Btu per kwhr
- Design—Outdoor, with ends of turbines, control room, and firing aisles enclosed
- Gross normal capacity—600,000 kw initially
- Generators—Four 183,824-kva at 0.85 pf, 18-kv, 3,600-rpm units
- Turbines — Tandem-compound, triple-flow
- Boilers—Radiant type; 1,135,000 lb/hr
- Steam Conditions—1,800 psi, 1,000/1,000 F
- Auxiliary supply—Unit system at 2.4 kv

Pittsburg Plant—

R. A. BOWMAN, Manager of Engineering, Power Division, Bechtel Corp, and

C. C. WHELCHEL, Chief, Division of Steam Engineering, Pacific Gas & Electric Co, San Francisco, Calif.

Pittsburg Steam Plant of Pacific Gas & Electric Co marks another combination of new engineering trends and sound design practices that result in low installed and operating costs. Scheduled for operation during the spring and summer of 1954, Pittsburg will have an estimated gross normal operating capability of 600,000 kw, making it the West's largest steam-electric station. Estimated cost per kw of capability, excluding cost of the high voltage switchyard, is about $120.

Best expected heat rate is about 9,550 Btu per kwhr. Basis for these expectations is founded upon:

1. Large size and number of main units.
2. Outdoor turbines and boilers.
3. Simplified plant design.
4. Good plant site and favorable cooling water supply.

The plant is of outdoor design and will consist initially of four turbogenerators of 156,250 kw guaranteed capability. Main units, except for the head ends of turbines, are in the open. Boilers are protected only by an umbrella-type roof extending some 9 ft below drum centerline. Principal enclosure contains the control room and firing aisles. Protected areas under the boilers and turbine pedestals also provide economical space for enclosed locations of equipment.

Four 3,600-rpm, tandem-compound, triple-flow turbine-generators are set in parallel with axes normal to boiler drums and steam headers. They rest on pedestals which

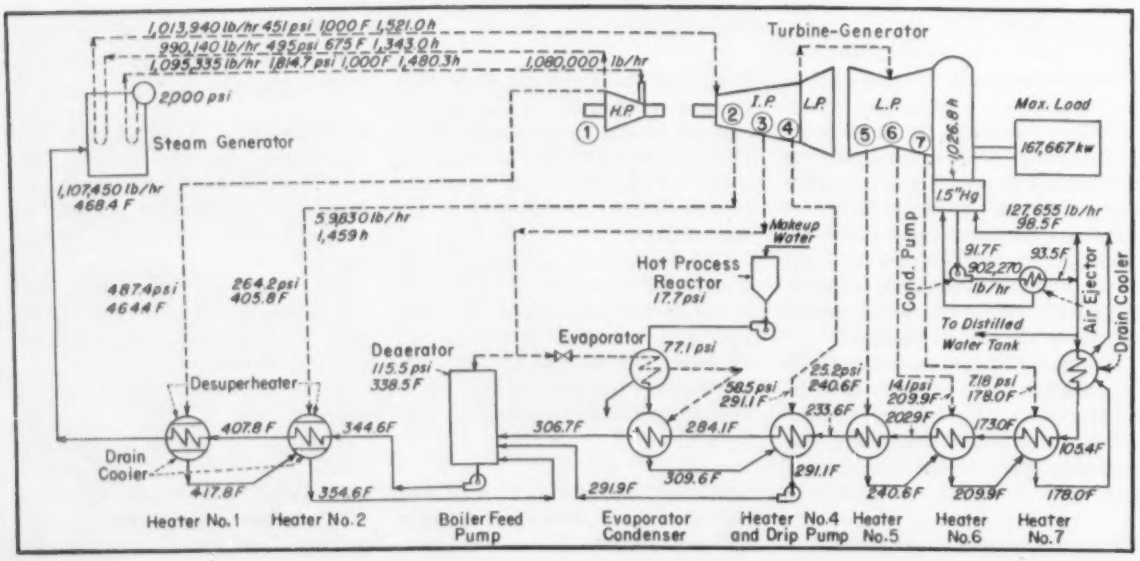


FIG 1—HEAT BALANCE for the 1,800-psi, 1,000 F reheat cycle in simplied form looks like this. Seven stages of extraction feedwater heating are used. System is designed with three evaporators and two evaporator condensers. Normal expected make-up will be 1-2%

Low First Cost Plus High Efficiency

project from the firing aisles and have their head ends inside the firing aisle wall. This eliminates the need for weather-proofing the governor end of the turbine. It also results in a minimum piping distance from boiler to turbine.

Uses Semi-Gantry Crane . . . Main units are serviced by a 60-ton semi-gantry crane, that has access to the high-pressure feedwater heaters, the spur track, and a laydown area adjacent to the machine shop. Crane capacity is adequate for all lifts except the generator stators, which will be rigged into position. During construction and when required for maintenance on the turbine-generators, a mobile canvas shelter is provided.

The radiant-type, reheat boilers are designed for steam conditions of 1,800 psi, 1,000/1,000 F. They will burn fuel oil or natural gas initially and also are arranged for conversion to coal firing. Primarily, this would involve installing furnace division walls to reduce heat absorption rates to values satisfactory for coal. Other changes would include modifications in burners and the draft system, additional soot blowers, and installation of dust collectors. Steam temperature is controlled by gas recirculation, supplemented by attemperation of both the primary and reheat steam.

The firing aisles contain, in addition to burners and burner maintenance facilities, certain equipment which has been shown to require close operating supervision or relatively frequent maintenance. Included are the evaporators and the boiler feed pumps. Because the pumps are mounted at the main operating level, the deaerating heaters, from which the pumps take suction, have been located 95 ft above the main operating level to prevent flashing of the feedwater. Thus, deaerating heaters are at nearly the same elevation as the boiler drums.

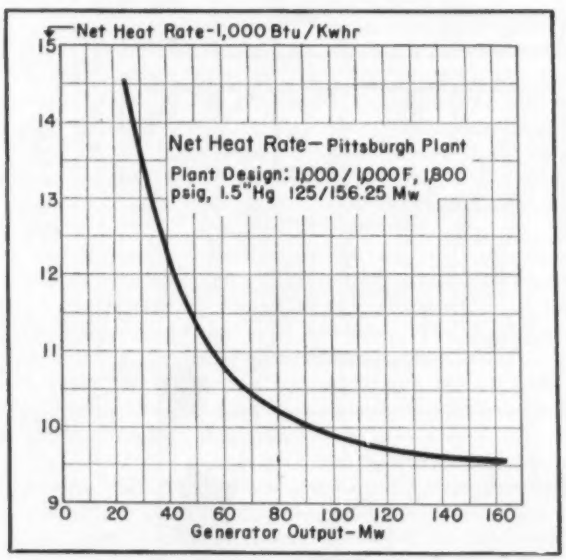


FIG 2—NET HEAT RATE at maximum efficiency, with oil used for fuel and 2% feedwater make-up, is expected to be 9,550 Btu per kwhr

Will Be Base Load Station . . . Pittsburg Plant is located west of Pittsburg on the southern shore of Suisun Bay, which connects by Carquinez Strait through San Pablo Bay to San Francisco Bay. The site is in the heavy industrial center which is expanding rapidly on the southern shore of the lower San Joaquin River.

Because Pittsburg is situated near the center of the PG&E system, it is expected to operate as a base-load system plant. High fuel economy, consistent with reliability of operation, is a fundamental requirement. For example, assuming plant-life capacity factor to be 60%, and fuel cost 28¢ per million Btu, a reduction of 1 Btu in the net heat rate would save $910 in fuel costs annually.

The heat balance for the 1,800-psi, 1,000 F, reheat cycle is shown in simplified form in Fig 1. The design net heat rate expected for the plant is plotted in Fig 2. This shows an expected maximum efficiency of 9,550 Btu per net kwhr, operating with 2% boiler make-up and burning oil fuel. The boiler guaranteed efficiency is 86.8% at full load.

The heat cycle for Pittsburg is relatively conventional. Seven stages of extraction feedwater heating are employed. The two vertical high-pressure heaters include desuperheating zones as well as drain coolers. The three lowest-pressure heaters are located in the condenser neck with drains that cascade to an external cooler and thence to the condenser. The cycle also includes a deaerating heater operating at variable pressure with load, evaporator and evaporator condenser, and a No. 4 heater, with drains pumped to the deaerator.

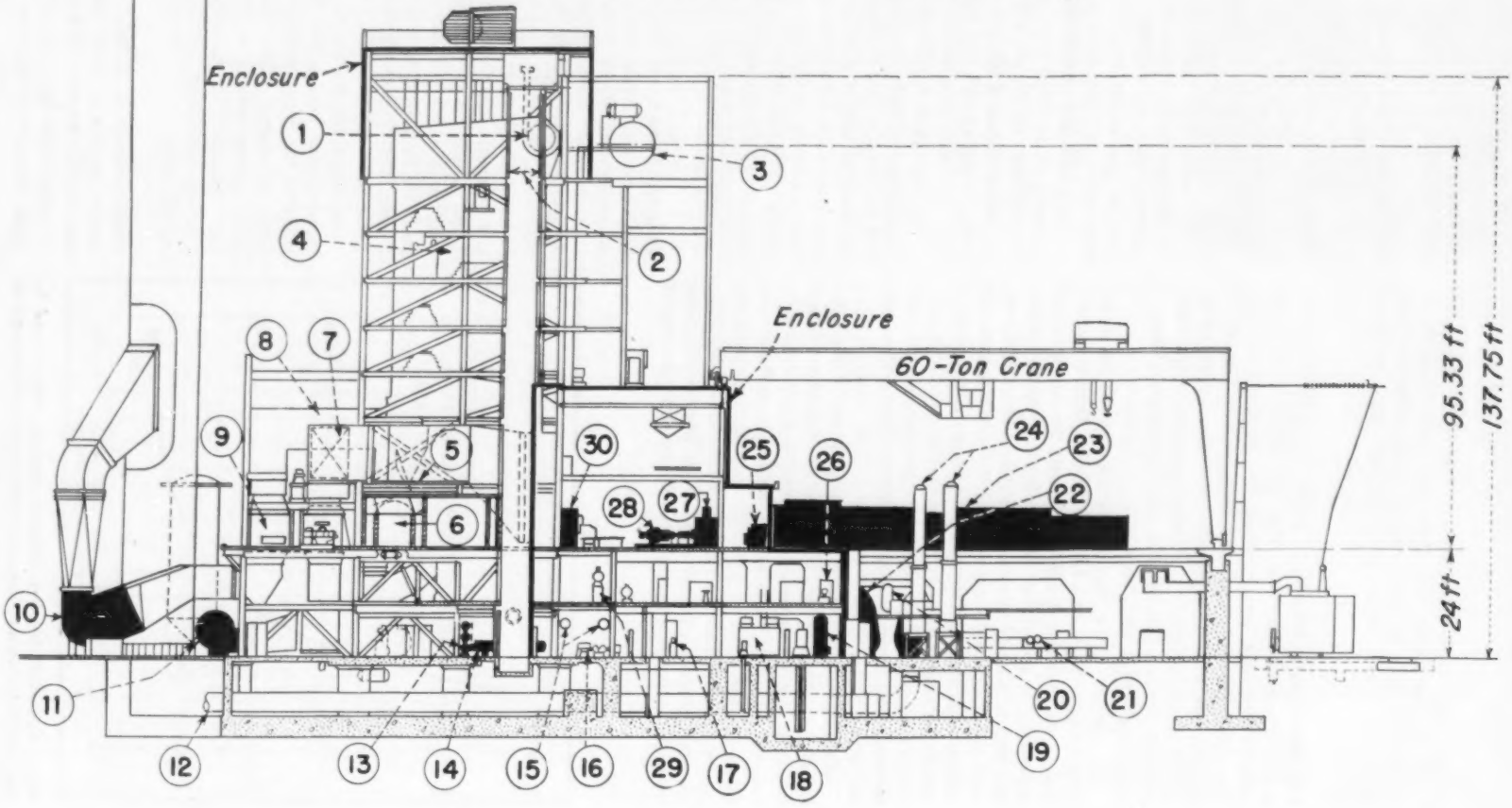
Expected Make-Up Is 1-2% . . . Three evaporators and two evaporator condensers are used. Units 1 and 4 have the arrangement shown in the station cross section; whereas Units 2 and 3 normally operate without an evaporator. All make-up is supplied from 1 and 4 during normal operation. For periods of heavy make-up an emergency high-capacity evaporator is provided. Steam is reduced and desuperheated from the main steam header of Units 2 and 3, and the evaporator vapor exhausts to the main condensers of Units 2 and 3. Total plant evaporator capacity is equivalent to 5% make-up at maximum load. During normal operation make-up is expected to run from 1 to 2%.

An interesting feature of the design is that the superheater outlet header and both reheat headers are not anchored but are permitted to rotate. This not only eliminates any sliding guides but also increases the flexibility of the piping systems as a result of the deflection of the tube elements. To minimize equipment reactions under operating conditions, 100% cold spring is applied throughout the system.

Units Generate at 18 kv . . . The four 156,250-kw generators operate at 18 kv and feed through transformers into the 115-kv and 230-kv transmission system. Unit 1 is connected to the 115-kv switchyard bus. Units 2, 3, and 4 are each connected to the 230-kv switchyard bus. Units

Pittsburg Steam Station—Pacific Gas & Electric Co

1 Steam Drum
2 Elevator Shaft
3 Deaerator
4 Boiler
5 Hopper
6 Gas Recirc. Fan
7 Air Duct
8 Gas Duct
9 Air Preheater
10 I.D. Fan
11 F.D. Fan
12 Circulating Water Inlets
13 Bearing Water Coolers
14 Reboiler
15 Sec. F.O. Heaters
16 Primary F.O. Pump
17 Heater No. 4 Drip Pump
18 Turbine L.O. Tank
19 Condensate Pump
20 Heaters No. 5, 6, & 7
21 Drain Cooler
22 Condenser
23 Main Unit
24 H.P. Heaters
25 Air Ejector
26 Main Cond. Vacuum Pump
27 Turbine Gage Board
28 Boiler Feed Pump
29 Evaporator Condenser
30 Boiler Control Board



are connected to transformers through 6,000-amp, isolated-phase bus runs.

Both high-voltage buses consist of double buses with selector switches. An autotransformer bank for power interchange is connected between the 115-kv and 230-kv buses with a 2.5-kv tertiary. This low-voltage winding will serve as emergency station power supply and will have a capacity adequate for simultaneous startup of two units as well.

Each unit supplies its own auxiliaries through an 18/2.4-kv, 10,000-kva, 3-phase, oil-insulated and air cooled transformer connected directly to the generator leads. In the event of a failure of any auxiliary transformer the 2.4-kv bus can be supplied from the tertiary winding of the 2.5/115/250-kv power interchange transformer bank. All motors above 400 hp will be supplied from the 2.4-kv system; motors of 400 hp and lower take power from the 480-v system.

The excitation system consists of geared 375-v, 375-kw shaft exciters and one 600-hp, motor-driven flywheel-type spare exciter. Each generator has a static-type voltage regulator which controls a motor-driven, rotating amplifier-type pilot exciter. Lighting feeders at Pittsburg are supplied through a combination packaged unit consisting of a dry-type transformer and voltage regulator housed in a ventilated steel cabinet. This follows a practice inaugurated by Pacific Gas & Electric Co at its Contra Costa Plant (EW, Jan. 25, p 214).

Control Room Serves Four Units . . . One air-conditioned central control room (Fig 3) serves all four units. Control boards for all major equipment are arranged in a hollow-square configuration around the operators' telephone booth. Master control and generator control benchboards with associated vertical instrument board form one full side and parts of the two adjacent sides in the square. The feed-water control benchboard occupies the opposite side. Station service, excitation control, and 125-v dc control benchboards complete the two sides partly occupied by the generator boards. Miscellaneous recording and meter panels are also located in the control room.

Control benchboards make use of conventional mimic bus as an aid to operation. To improve readability of instruments which are often read from the operators' telephone booth, 8¾-in. expanded-scale instruments will be used on the generator vertical instrument boards. Upper parts of the vertical generator and master instrument boards contain 6 x 12-in. annunciator windows with lettering of a size adequate for reading anywhere in the control room.

Each annunciator indication will always appear on a 6 x 12-in. annunciator and in certain instances also on a 1 x 1-in. annunciator located on the switchboard containing the control of the equipment in trouble. The annunciator operation is also accompanied by an audible alarm.

Control room will be lighted by a luminous ceiling. Lighting is designed to provide a maintained level of 50-60 ft-c with a minimum of glare.

Seismic Factor Is 20% . . . Soil at the Pittsburg site is sedimentary in character and contains layers and lenses of clay, sand, and peat. Studies were made to determine a plant location where the peat layers could be removed by excavation. Bearing pressures under the foundation were distributed by the use of a continuous concrete mat five

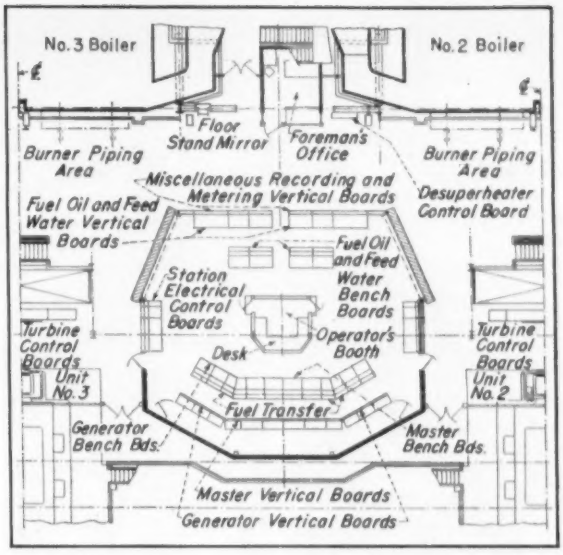


FIG 3—CONTROL ROOM for all four units is located in middle of plant. Room will be air conditioned and illuminated to 50-60 ft-c

feet thick. The structural frame of the building was designed with special consideration given to seismic loadings because there are several well-known earthquake faults in the vicinity of the plant. Although the 1946 Uniform Building Code factor might have permitted 8%, seismic factor for the plant was assumed as 20% of gravity.

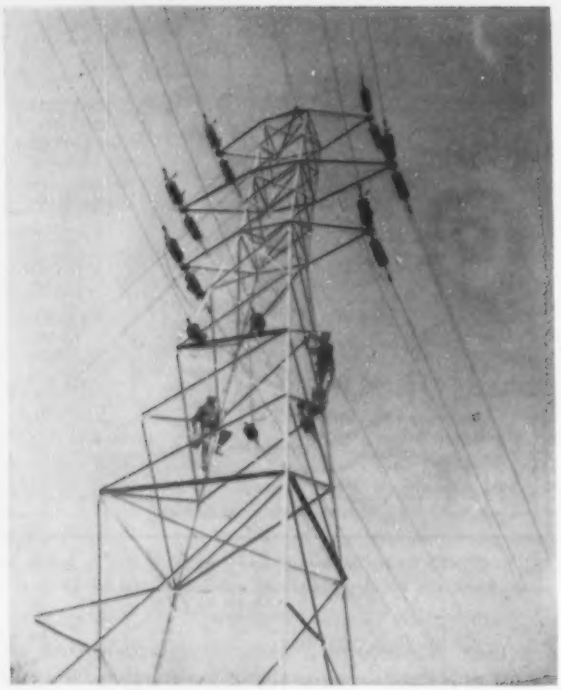
The single-pass condensers have a surface of 65,000 sq ft and will maintain a back pressure of 1.5 in. of mercury on 70 F water. Chlorinators are provided for slime control if this should prove to be a problem. Circulating water intake and discharge structures are located on the shores of Suisun Bay and are separated by about 900 ft. Numerous studies were made of stream flow in the river and bay area in front of the plant. From these studies, the discharge outfall has been located as far upstream as property limitations would permit. At this point the discharge water will carry out into the main stream flow and by-pass the intake.

It should be noted that no interconnection exists between circulating water pumps and lines for the four main units. No valves have been provided on any of the circulating water intake or discharge lines.

Basic Fuel Is Oil . . . Primary fuel for Pittsburg will be oil, delivered by tanker and possibly by overland pipe line. A dock will be built to accommodate tankers of 115,000 bbl capacity. Super tankers of 175,000 bbl capacity may be tied up and discharged. However, the channel must be dredged deeper to allow such ships to come in fully loaded. The oil will be pumped to the six 167,000-bbl storage tanks. This storage is sufficient for about 40 days' operation at full load.

Natural gas also will be burned when surplus is available in the area. This will be delivered by a 24-in. pipe line from PG&E's gas transmission system which is supplied from several sources. The plant is also adaptable to burning coal if that fuel should become economical in California. Space is allocated for a coal pile and for necessary conveyors, bunkers, pulverizers, etc. Coal can be delivered at that time by rail or by water.

Maintaining 21,000



L. K. YERGER, Superintendent of Meters and Test, Niagara Mohawk Power Corp, Buffalo, N. Y.

Approximately 21,000 steel towers supporting transmission conductors, some dating back to 1906, present the Niagara Mohawk System with a sizable problem in maintenance.

In meeting this problem, Niagara Mohawk has experimented with inspection of tower tops and arms by helicopter, painting materials and schedules, and methods of combating underground corrosion of steel.

Approximately 90% of the system's towers are the flex type, a construction carrying the steel work through the ground line and about 8 ft below grade to I-beam supports and appropriate anchorage. The remainder are square towers, anchored in a variety of ways, depending on age and construction period. Many of the latter are set on concrete foundation footings either at or above grade level.

Inspection . . . Patrolmen inspect the mechanical condition of towers above grade, and records are kept of these inspections. The inspection of the tops of the towers and the arms has always presented a special difficulty. A helicopter has been employed on several Western Division circuits on an experimental basis with reasonable success.

These aerial inspections were made by an observer equipped with a chest-type microphone who dictated his observations into a wire recorder in the cockpit. Such observations, especially when binoculars are used, permit gathering data on rusting and corrosion. The helicopter can be held in one position long enough for the observer to note the condition of insulators, supporting hardware and conductors.

Above-Ground Painting . . . Of towers in service about 25% originally were galvanized. A study made on 1,300 of these provided interesting data. About 45% went for 30 years before painting was necessary, and 20% went for 32 years. A small group in an industrial area and along a railroad right-of-way needed painting between 10 and 20 years after installation.

Niagara Mohawk has tried many paints on the exposed parts of towers, and especially on those in the Niagara Falls area. There the concentration of chemical industries intensifies corrosion of the above-ground parts.

The system's present procedure for the bulk of tower paintings in Western New York calls for wire brushing of the steel work to remove loose scale, followed by application of a primer coat of 24 lb of 97% grade red lead-linseed oil paint. The finish coat is black modified alkyed-linseed oil resin type paint. After six years exposure these coatings show a good gloss. Niagara Mohawk expects an additional five or six years of life will be obtained under the usual atmospheric conditions.

Cost studies over the last six years on 2,984 towers indicate an average painting cost per tower of $73.60, including an average labor cost of $1.90 per hr. As the above number of towers represents 8,524 tons of steel, the painting cost per ton is $25.70.

Painting Schedule . . . Niagara Mohawk's painting schedule takes into account the difficulty of shutting down lines. The bottom section of the tower is painted first, and the upper section whenever opportunity is offered by a line shutdown. Often such shutdowns occur in overtime work periods, quite frequently on week ends.

Niagara Mohawk holds forums for supervisors charged with painting responsibilities. At these forums, the handling of men, the use of safety equipment and platforms, a variety of structural problems, and the proper cleaning of steel are among the subjects discussed. This preparation, it has been found, results in a better paint job.

Footing Problems . . . Any transmission system experiences the severest problems in routine steel tower maintenance at and below the ground line.

Niagara Mohawk's towers, spaced between 500 and 600 ft apart, support heavy loads of copper and aluminum conductors. Consequently, stress load at the ground line is quite high at times, particularly when the conductors are iced and subject to a strong wind. Conductors then tend to gallop and go through oscillating gyrations which strain conductors beyond elastic limits at times. In such circumstances the towers weave and bend, thus putting considerable stress on the fulcrum in the ground line area.

Where tower strength is essential, at the ground line and for some 8 to 10 in. below, corrosion is most active. Soil aeration attacks steel coatings, plant life retains water, and some movement of the tower is present the year round. Besides the movement caused by the wind on sleeted lines, there is the spring heaving of the soil as the frost leaves the ground.

Niagara Mohawk lines generally are protected by an

Towers Poses Painting Problems

overhead ground wire which on occasion carries galvanic currents that may leave the tower footings at unpredictable locations. Such galvanic action takes place especially where large gas, oil, or water transmission lines cross the tower line right-of-way. There has been a considerable increase in pipe line construction in the last few years since natural gas has been made more available in the East.

Anti-Corrosion Coatings . . . Niagara Mohawk has experimented with coatings for slowing down corrosion within the ground-line area. Some years ago, it treated footings with asphalt-rubber compounds, or combinations of asphalt and coal-tar compounds. These were applied with a mastic spray gun on steel cleaned of scale and other foreign matter by wire brushing. Channel edges were covered with cotton fabric to provide a suitable surface for building up the compound.

But moisture crept in between the steel and the asphalt and was held in pockets. After several years corrosion became apparent. Niagara Mohawk concluded that an unusually thick coating, nearly ⅛ in., was unsuitable. Such coatings are attacked by flexing of the steel, frost, the spring heaving of the ground, and probably by alkaline ground water.

These coatings, however, proved good corrosion protection for steel above ground. Such steel needs a protective covering highly resistant not only to abrasion but also to mild acid and alkaline waters. But to be economical, the material must be applied in not more than two coatings because of the travel time and difficulty in reaching tower locations in hilly or swamp areas.

Studies in Progress . . . Tower footings have been coated with air-drying paints after excavation to 18 in. below grade. Steel in the excavated area was thoroughly cleaned by a brush type flame of oxygen-propane gas, which tends to burst off rust and scale and dry out the steel. Dust deposits were removed by wire brush, and experimental coatings applied while the steel was still warm. Coatings applied were:

1. Primer of linseed oil vehicle, 24 lb of 97% grade red lead, and a finish coat of linseed oil-lead suboxide and aluminum pigmented type of paint.

2. Modified alkyd 16 lb of 97% grade red lead primer and a finish coat of modified alkyd phenolic carbon black material.

3. One coat of plasticized coal-tar air drying material.

4. One coat of plasticized coal-tar material mixed with zinc dust.

5. Lead chromate primer with graphite type of finish coat.

6. Modified phenolic iron oxide primer with a finish coat of alkyd resin vehicle carbon black material.

7. Modified phenolic iron oxide primer, one coat of plasticized coal-tar air drying material.

8. Two coats of phenolic vehicle aluminum.

9. Modified phenolic iron oxide primer, finish coat of linseed oil aluminum flake.

10. Modified phenolic iron oxide primer with phenolic zinc dust finish coat.

11. Two coats of modified phenolic resin zinc dust material.

12. Recently added epon resin chemically curing coatings.

After three years' exposure, the modified phenolic iron oxide primer and one finish coat of air-drying plasticized coal-tar seem to perform very well. The priming coat of modified phenolic resin must be applied shortly after flame cleaning and while the steel is quite warm. Finish coat may be applied any time after 24 hr have elapsed.

Cathodic Protection . . . Niagara Mohawk has considered use of magnesium or zinc anodes on footings where potentials are conducive to corrosion. The anodes would provide the protective voltage for swinging the copper-sulfate to earth potential to approximately 0.8 to 0.9 v.

The system has not yet encountered a situation calling for a rectifier type of cathodic protection. When it does, it will provide a protective shunt to the rectifier to bypass high fault current on the line. Niagara Mohawk has investigated the practicability of a device consisting of thyrite discs for providing a protective medium under high current conditions. Having a low resistance, this device would bypass the fault current.

Niagara Mohawk has found no conditions indicating anaerobic attack and only a few instances of organic nitrates working directly against coatings and steel. Vinyl coatings, or coatings now under study, the system believes, can help protect footings in soil containing organic nitrates.

Cooperation Needed . . . It is the experience of Niaraga Mohawk that the cooperation of companies having pipe lines near the tower line right-of-way is essential to a satisfactory solution of problems of footing corrosion.

For instance, Niagara Mohawk's corrosion troubles were aggravated by the action of one company with an oil line parallel to the tower line. This company applied cathodic protection rectifiers in an area where readings taken to earth with a copper-sulfate cell showed the presence of galvanic voltages between the footings and the earth.

Similarly, another pipe line on the Niagara Mohawk right-of-way was equipped with insulating flanges. As the system's ground wire could not possibly be insulated, it acted as a shunt to the pipe line insulating flanges. As a consequence, the ground wire carried some cathodic protection current beyond the intended zone of protection, and current from the tower footings provided a corroding medium for the footings.

The latter situation held drastic possibilities. In the event of ground fault conditions, resulting in insulator flashover due to being struck by lightning, current could be transferred through the tower footings. Ground fault current could puncture the mastic coating on the pipe line and/or bridge the insulating flanges thus further reducing the protective system and, if the ground bed is close to the transmission line, could damage the cathodic rectifier element.

Here Are the Steps in Designing Voltage Regulation for an . . .

Economic Rural Distribution System

Recommended tolerable utilization voltage limits are the logical basis for planning and for subsequent operating practices. Voltage regulators should control voltage spread at substation output and correct excessive voltage drop on line

ROLAND W. SCHLIE, Electric Engineering Division, Rural Electrification Administration, U. S. Department of Agriculture, Washington 25, D. C.

The proper application of voltage regulating equipment at key locations of a rural distribution system affords a more economic design. More customers get service at a voltage approximating the rated voltage of utilization equipment.

Table I. Voltage Spreads And Levels for Rural Distribution System Design

(120-V Base)

Location	Spread (In Volts)	Voltage Levels Min	Max
Point of Utilization	20	107	127
Service Delivery (Meter socket)	17	110	127
Distribution Transformer (Primary)	11	116	127
Substation Bus (Output)	3*	124	127
	4**	120	124
Substation Transformer (Output)	18	114	132

* Full-load.
** Light-load.

Table II. Voltage Drops for Rural Distribution System Design

(120-V Base)

Section of System	Volts Drop	Percent Voltage Drop (Approximate)
Substation Bus (Output) to Last Distribution Transformer (Primary)	8	7
Distribution Transformer (Primary) to Service Delivery (Meter Socket)	6	5
Service Delivery (Meter Socket) to Point of Utilization	3	3

The tolerable utilization voltage limits recommended by the EEI-NEMA Joint Committee on Preferred Voltage Ratings are the logical basis of such a design. These limits are also the basis for establishing operating practices for voltage regulation on rural distribution systems. Their proper interpretation provides:

1. Voltage spreads at controlling points of a distribution system.

2. Voltage drops in components of the system.

3. Voltage correction available from substation and supplementary regulators.

4. The relationship between band width and volts of correction.

5. Best locations for supplementary regulators.

Analysis of the application of voltage regulating equipment on rural distribution systems requires that the design values of the voltage spreads and voltage drops be known. The voltage standards used hereafter are given in Tables I and II.

Rural and Urban Systems. . . Two particulars differentiate a rural from an urban system. Each transformer on a rural system serves one transformer but on an urban system serves several. Consumers on a rural system are at or very near the substation, but on an urban system there is an express feeder between consumers.

Consequently, a rural system is designed to operate with a relatively large voltage drop, 8 v, between the first and last distribution transformer. The voltage drop on an urban system is only 3 v. While the output voltage of a rural substation is limited to the maximum voltage at the first distribution transformer, no such limitation applies to the urban substation.

Line-Drop Compensator. . . The designer of a rural distribution system wants a voltage regulator to compensate for line voltage drop by either of two techniques. A line-drop compensator's resistance and reactance settings can be adjusted in proportion to the line resistance and line reactance for the maintenance of constant voltage at a remote location. The line-drop compensator can also be adjusted to obtain a desired increase in voltage proportional to the circuit load.

The graphs in Fig 1 show the relationship between regulated output voltage and power factor for various settings of the line-drop compensator. The solid curves represent

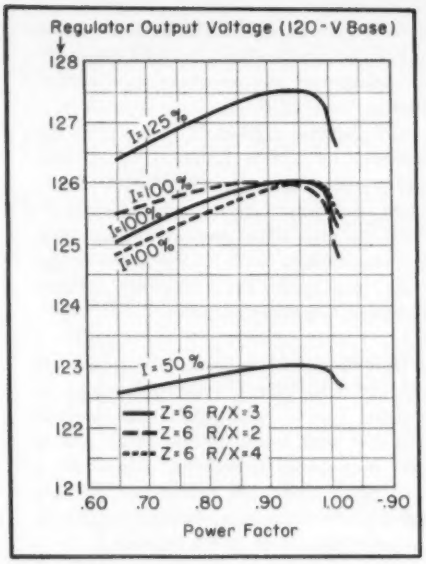


FIG 1—REGULATOR OUTPUT VOLTAGE and power factor for various compensator adjustments

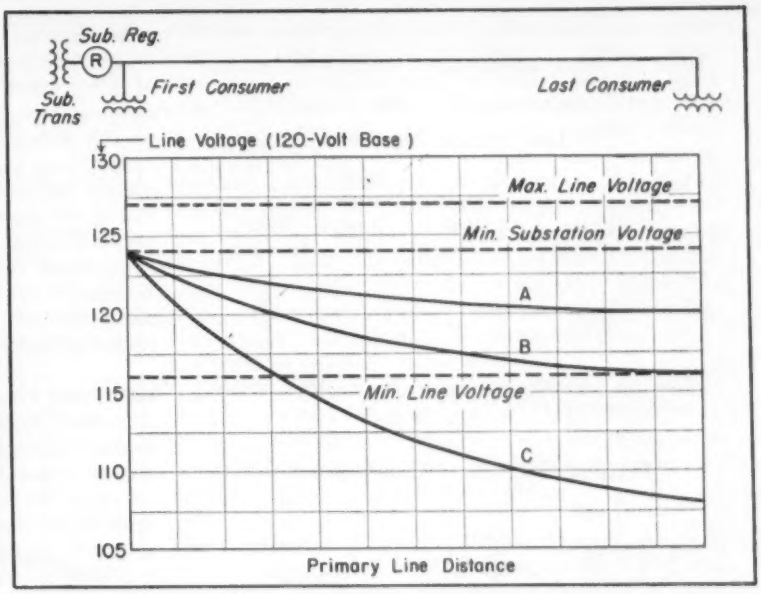


FIG 2—VOLTAGE PROFILES of distribution lines with total voltage drops at peak load of 4 v (Curve A), equal to the allowable drop (Curve B), and 16 v (Curve C)

a resistance-to-reactance ratio of 3:1 for load current equal to 50, 100, and 125% of the rating of the regulator current transformer primary. The two dash-line curves represent ratios of 4:1 and 2:1.

These curves illustrate the adjustment of a line-drop compensator so that the regulator's operation becomes a function of the load voltage and current. For resistance-to-reactance ratios between 2:1 and 4:1, the change in output voltage, due to variations in power factor from 0.85 to 1.0, may be neglected.

Within the above limits the line-drop compensator may be employed as a load follower. The regulated output voltage can be increased proportionately as load current increases and decreases as load current declines.

Applications. . . On rural distribution systems, the two fundamental applications of voltage regulators are:

1. To control voltage spread at the output of substations.
2. To correct excessive voltage drop along lines.

Economic system design necessitates application of regulators in substations. The maximum permissible voltage drop along the distribution line equals the voltage spread on the line minus the substation output voltage spread. Thus, excessive substation output voltage spread decreases the maximum permissible voltage drop along the line. Normally, substation output voltage cannot be adequately controlled without regulators. Initial design of a rural distribution system should provide for substation regulators.

Initial Design. . . Application of regulators on the distribution line is limited by the thermal capacity of conductors and the economics of line losses. Specific studies may indicate their inclusion in the initial design of a distribution line. Their inclusion, nevertheless, effectively excludes economical corrective means when excessive voltage drop renders the line inadequate.

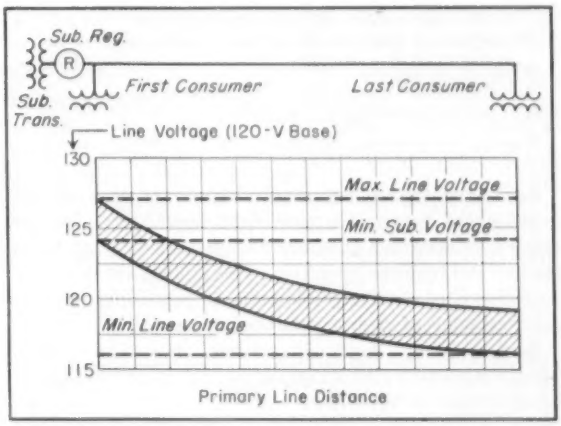


FIG 3—LINE VOLTAGE VARIATION is due to substation output spread. Band represents line voltages corresponding to variations

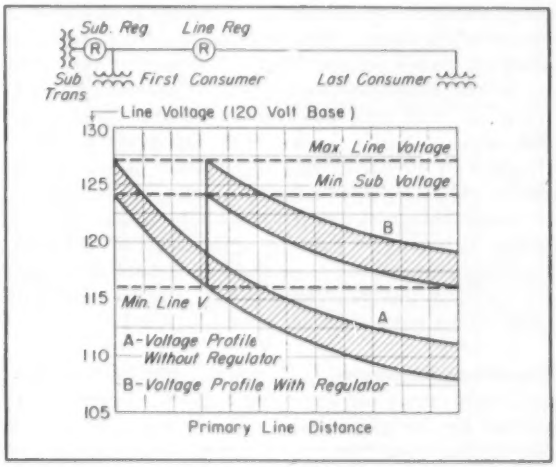


FIG 4—VOLTAGE PROFILES show voltage improvement by use of a line voltage regulator. Maximum correction is illustrated by Curve B

Table III. Recommended Band Width Adjustments and Corresponding Correction Capability of Line Voltage Regulators

Size of Step	Number of Steps	Band Width Total Volts	Volts* Correction
2½% or 3 V	4	4	7
1¾% or 1½ V	8	3	8
1¼% or 1½ V	16	2	9
⅝% or ¾ V	32	2	9

* Correction capability of regulators based upon a primary voltage spread of 11 v.

Table IV. Location of Line Regulators

Band Width (Total Volts)	Volts Correction* (From Line) Regulator)	Location**
2	9	47%
3	8	50%
4	7	53%

* Based upon a primary voltage spread of 11 v.

** The voltage drop from the substation to the line regulator is expressed as a percent of the total voltage drop along the line at any time.

Consequently, regulators are not usually provided for in the initial design of a rural distribution line. They are employed later when excessive voltage drop develops along the line and requires correction. This application is a practical means of deferring rephasing or rebuilding until an exact estimate of requirements can be made.

Because of the large voltage drop on a rural system, voltage regulators play an important role in providing adequate voltage for consumers.

Substation Application. . . Voltage control is accomplished in substations on the load side of the transformers. Normally, some rural consumers are connected at or very near the substation output. This situation limits the maximum substation output voltage. Three-phase feeders vary from one to four, depending largely upon the size and configuration of the load area. Bus regulation meets the usual requirements of voltage control at the substation output.

Substation voltage control requirements determine the type of regulator in the substation. As given in Table I, the substation output voltage spread is 3 v during full load (124 to 127-v) and 4 v during light load (120 to 124-v). The range of regulation required of a regulator for substation control is ±10%. The regulator must be capable of maintaining a band width not greater than ±1 v.

Three-Phase Regulators. . . Three-phase regulators employ one control circuit and one motor to drive a 3-phase gang-operated tap-changing mechanism. The voltage-regulating relay is controlled from one phase-to-phase voltage and the current of one or two phases. Thus, a 3-phase regulator is not completely capable of correcting voltage variations resulting from unbalanced 3-phase circuit loads. Single-phase regulators provide individual voltage control of each phase of a 3-phase circuit. Unbalanced 3-phase circuit loads do not affect the degree of voltage control possible with a 3-phase bank of single-phase regulators.

Bus regulation with 3-phase regulators is specified frequently for substations. Its cost is generally lower than that of bus regulation with single-phase regulators. Actually, the predominant load served by the substation determines which method of regulation should be employed. With predominantly single-phase loads on a system, single-phase regulators are employed. Predominantly 3-phase loads on a system indicate 3-phase regulators.

Unbalanced Phase Operation. . . Unbalanced phase currents often result on multi-grounded neutral systems serving predominantly single-phase loads. Although circuit loading may be arranged so that peak load currents of all phases are equal, the peaks may occur at different times. As a result of unbalanced phase operation, phase voltages are not equal. By using 1-phase regulators, voltage control of each phase is independent of system phase balance.

Generally, single-phase regulators should be employed for voltage control in rural distribution system substations.

Parallel Operation. . . Regulators are not operated in parallel unless the loop impedance is high, requirements for parallel operation of transformers are met, and modifications of the control circuit are made. On rural distribution systems the application of regulators operated in parallel is not normally practicable because the circuits have a very low loop impedance.

A rural distribution system, having consumers at or near the substation output, usually dispenses with an express portion of the feeder line. What the rural system wants is a voltage increase proportional to the circuit load. In all

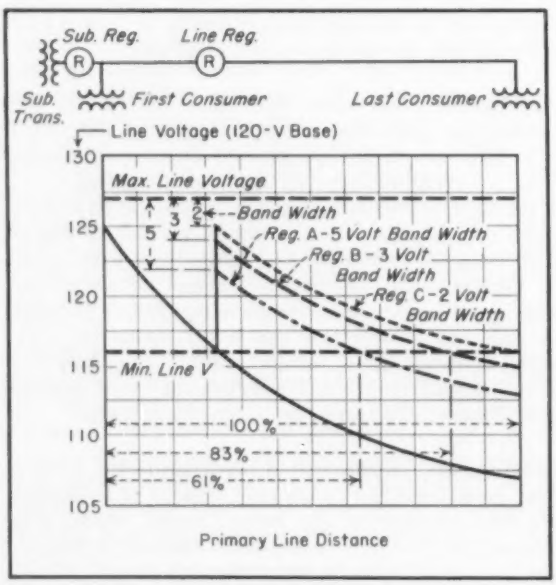


FIG 5—VOLTAGE CORRECTION capability expressed as percent of line length. Profiles show correction by three types of regulators

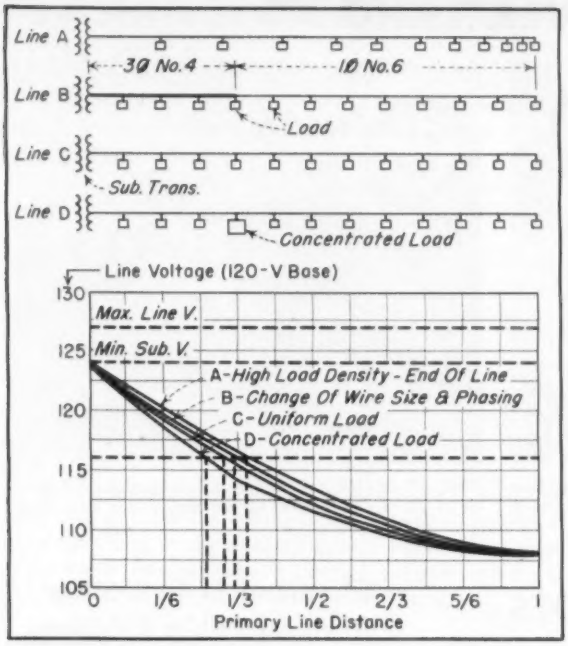


FIG 6—VOLTAGE PROFILES show variations due to loading, conductor size, or phasing along line. Regulator locations are also shown

applications of regulators, however, care must be exercised to prevent over-voltage at the first consumer.

Regulators are designed to withstand a short-circuit current of 25 times normal for two seconds or less. Where individual feeder regulation is used, the short-circuit current of the substation should be calculated to determine that the short-circuit capacity of the regulator is not exceeded. Often it is possible to locate an individual feeder regulator some distance from the substation. The added circuit impedance reduces the short-circuit current on the load side of the regulator.

Line Application. . . As a distribution line becomes inadequate because of excessive voltage drop, regulators may be employed as a corrective measure. Generally regulators prove economical as a corrective until the sum of the voltage drops along the line equals approximately twice the allowable drop. In accordance with the allowable line voltage drop in Table II, regulators may be economically employed to correct approximately 8-v excessive drop.

When a distribution line is first energized, following initial construction or rebuilding, the voltage drop along the line is considerably less than the allowable 8v maximum. Curve A in Fig 2 is the voltage profile of a newly energized line having a total voltage drop of 4 v at peak load. As the peak load increases, the voltage drop at peak load increases and the total voltage drop becomes equal to the allowable voltage drop.

Curve B in Fig 2 is the voltage profile of a distribution line having, at peak load, a total voltage drop equal to the allowable voltage drop. If peak loads continue increasing the distribution line becomes inadequate as a result of excessive voltage drop.

Curve C in Fig 2 is the voltage profile of a line having a total voltage drop of 16 v, 8 v excessive drop which may well be corrected by a regulator.

When To Install. . . The regulator installation should be made when peak loads cause approximate 7 v drop. Excessive voltage drop is then corrected during the period when peak loads cause the total line drop to increase to 16 v or until excessive voltage drop is correct by other means.

The voltage profiles in Fig 2 do not show the voltage variations occurring at the substation output. These variations are present along the entire length of distribution line. Fig 3 illustrates the effect of voltage variations along the line as a result of substation voltage control. Voltages along the line are represented by a band drawn to correspond to the substation voltage variations. When single-line voltage profiles are drawn, the minimum substation output, 124 v during full load, should be used.

Curve A in Fig 4 is the voltage profile of a distribution line having a total voltage drop of 16 v; Curve B is voltage profile of same line with installation of a line regulator to correct excessive voltage drop. The substation output and the line regulator have a 3-v band width.

Line Regulators. . . Line regulators can be installed before excessive voltage drop develops along the line. This will then correct excessive voltage drop resulting from increasing peak loads. Maximum correction from a line regulator is illustrated by curve B in Fig. 4.

The allowable voltage drop along a distribution line beyond a line regulator is equal to the voltage spread of the line minus the output voltage spread of the line regulator. Stated in another way, the correction capability of a line regulator is equal to the voltage spread of the distribution line minus the regulator band width. Table III gives the recommended band width adjustments and corresponding capabilities of line regulators.

For each regulator installation the voltage drop from substation to regulator is 8 v. The total allowed drop along the line depends upon the correction capability of the regu-

(*Continued on page* 213)

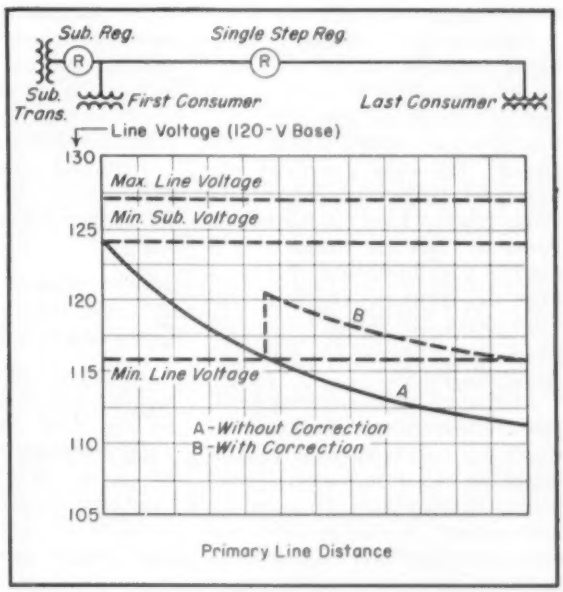
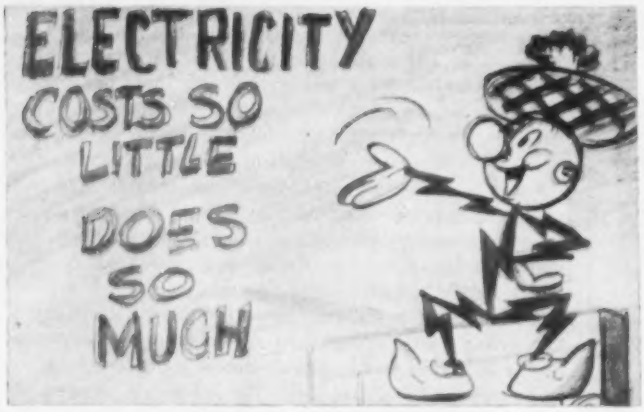
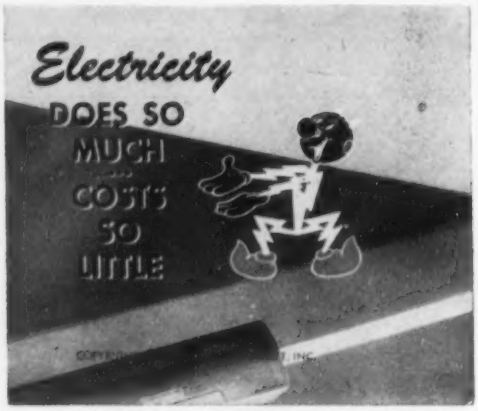


FIG 7—SINGLE-STEP REGULATOR is boosting. Curve A is voltage profile of line with 12.5 maximum drop; Curve B is corrected profile



PENCIL SKETCH of each scene is first prepared to give the cartoonist an idea of what is wanted. Ten or more frames of the finished film are based on each



FINISHED FRAME looks odd as it is in reverse. TV spectators will see Reddy with his red body and a white head

Utilities Make 8 TV Spots

Nine Southwestern companies and Reddy Kilowatt Service offer commercials in color and sound to promote appliances

Nine Southwestern electric companies and Reddy Kilowatt Service have teamed up to bring the industry its latest selling tool—television commercials. Eight 20-second spots in color and with sound are now available. Two promote the electric range and two lighting. The other four cover the home freezer, upright and cabinet; the clothes dryer; and the home laundry.

The idea started with Dallas Power & Light Co and a number of neighboring companies. Each was considering the preparation of such commercials but found the cost prohibitive. Finally they determined to back a joint project. The eight companies who joined the Dallas company are Arkansas Power & Light Co, Kansas City Power & Light Co, Kansas Gas & Electric Co, Mississippi Power & Light Co, Oklahoma Gas & Electric Co, Southwestern Gas & Electric Co, Texas Electric Service Co, and Texas Power & Light Co.

As all of the companies were Reddy Kilowatt users, it was decided to use Reddy in all of the spots. This led the companies to call in Reddy Kilowatt Service as consultants. When the first spots proved successful, RKS was asked to market them to all other of its clients. The money secured will be put into a revolving fund which will be used to finance other spots.

The high cost of a 20-sec spot is due to the amount of work that goes into it. Each spot consists of 480 frames or pictures. Each of these is first drawn in pencil. Then each of the backgrounds required is drawn in watercolor on cardboard. The animation (drawings for moving figures) are then prepared on pieces of celluloid commonly called cels. Each cel consists of a figure or figures outlined in ink and filled in with opaque watercolor. The cels are then superimposed upon the proper background and filmed. The first film is 35 mm. For the final prints the size is reduced to 16 mm.

The sound track is made separately and dubbed in. Walter Tetley, TV actor, supplies the voice of Reddy Kilowatt.

Gets Match Book 'Joshua'

Citizens Utilities Co has been awarded a bronze "Joshua" plaque for the most distinguished use of match book advertising in the utilities industry in 1953. The award is sponsored by the Match Industry Information Bureau which represents the five major match manufacturers. Formal presentation will be made in April. Consolidated Edison Co of New York has received a certificate of merit.

Cleveland El Gets Silver Anvil for Public Relations

Cleveland Electric Illuminating Co has been awarded the Silver Anvil trophy of the American Public Relations Association. The award was accepted April 6 by John O. Gunn, manager of public relations, at the annual convention of the association at New York. The company competed in the utilities division.

The award was based on the company's long-established policy of providing the public with complete information concerning its operations in emergencies as well as under normal conditions. Particular mention was made of the public relations handling of the gizzard shad "invasion" of Avon plant in February and the June 8 tornado. In both happenings the company fully cooperated on a 24-hour basis with news-gathering agencies.

A case history summarizing public service aspects of the company's performance in the two emergencies will be placed in the Library of Congress and made available to public relations classes at American universities.

Georgia Contest Popular

Georgia Power Co has announced that 284 towns in its service area have entered the 1954 Champion Home Town Contest. Prizes totaling $8,950 will be awarded to towns in three population groups which show the most community improvement between Oct. 1, 1953 and Oct. 1, 1954.

WASHINGTON COMMENT

JESSE MOCK

You can expect a round or two of legislative fireworks when the Senate turns its attention to federal power matters later this session.

As of now the public power strategists are keying their battle plans to just two major issues, but may add more before the session is over. Their immediate aims are to:

For the Senate: Couple rounds of fireworks

- Break through the barrier imposed by the Eisenhower Administration against any further power expansion by the Tennessee Valley Authority.
- Get funds for continuing present arrangements between Southwestern Power Administration and five generation and transmission cooperatives in Missouri and Oklahoma.

If an appropriate opportunity comes, there will also be attempts to secure more funds for federal hydroelectric projects, increase the House-approved figure for Bonneville Power Administration transmission funds, and possibly fight a few delaying actions on other fronts.

Niagara Action Discounted . . . Should legislation come to the floor for additional power development at Niagara Falls, there would be a decided shift of strategy. The reason Niagara power does not figure in the above schedule is that few people believe it will come out of the Senate Public Works Committee in time for floor debate at this session. Even if it does, they think it will be different enough from the House bill to preclude decisive Congressional action.

There is also a possibility there will be a minor skirmish over authorization of the sizable Upper Colorado Power and Reclamation Development, but not strictly along public-vs-private power lines.

Unless there is an unexpected turn, it looks like two of the most controversial federal power policy issues will not be brought before the Senate for decisive action, although they will be discussed at length during the coming debates. These are the Interior proposal for marketing federal power in Georgia and the fight between public and private interests over power development at the Hells Canyon site in Idaho. Public power advocates haven't figured out yet how they can bring these matters more directly into the legislative arena.

The big federal power fight this year will come over increased funds for TVA where additional power expansion is at stake. Symbol of that fight is the proposed 450,000-kw Fulton Plant which TVA wants to build north of Memphis. The Administration for two straight years has denied funds to begin construction, and the House has held fast—even doing a little further trimming on the Administration requests.

On recent teller votes, the House opposed 139-to-87 providing funds for starting the Fulton Plant and concurred 146-to-132 with its appropriations committee in trimming TVA funds $38 million below the $141.7 million Administration requests.

TVA Hassle as Usual . . . House action knocking out two legislative riders on the TVA funds bill was clouded by the parliamentary situation and is not clearly indicative of TVA support in that body. These riders would have required the agency to pay the average government rate of interest on its power investment and give up its authority over retail power sales.

In the debate which led up to House action on TVA funds, Republican Rep John Phillips of California described the committee action in this manner:

"We have no thought of sending this calf (TVA) to the butcher . . . all we are trying to do is wean it."

There are a number of TVA area Senators who have a far different view of the situation and they are picking up support from public power legislators from other parts of the country. This is a fairly clear-cut federal power issue, and the public power Senators are preparing to test their strength on it.

Of considerably less importance from a long-range viewpoint is the fight shaping up over funds for SPA. Situation is that SPA is now helping five G&T co-ops in Missouri and Oklahoma to stay on their financial feet by leasing their transmission lines and purchasing power from their steam plants. In time it is hoped that these co-op facilities can be integrated into an area-wide federal-co-op-private power grid. But since Congress abrogated contracts last year which would have permitted a federal-co-op grid, the co-ops have been existing on the interim arrangements with SPA. The House evidently felt that if more SPA funds were provided, there would be no incentive to consummate negotiations on the area-wide grid.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Lumens emitted per watt by fluorescent lamps increase as the frequency is raised, with a plateau reached at about 10,000 cps.

System stability is not a dominant problem in connection with possible operation of induction generators in parallel with synchronous machines.

Vista for young engineers in power plant and system operation was never so alluring. Complexities calling for intelligent initiative have increased faster than the mechanization to deal with them automatically.

Transmission at 315 kv is in general cheaper per kw-mile for any distance up to 600 miles and circuits up to 6 than either 287 kv or 345 kv.

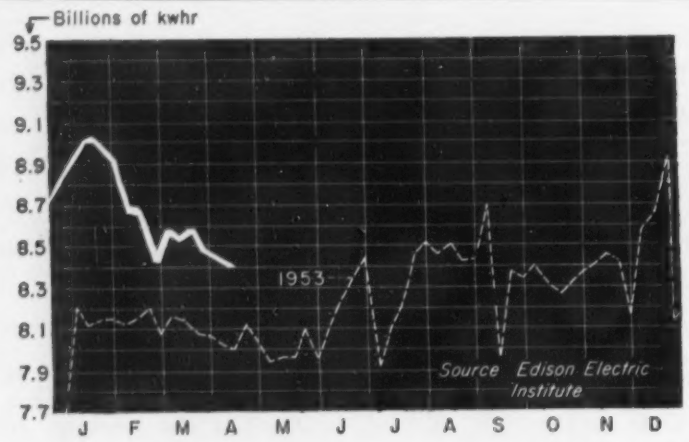
Noise level change as the voltage impressed upon a transformer departs from normal value is usually between 0.2 and 0.3 db per percent change in voltage.

Buried lead cable is normally cathodic to iron or steel but in alkaline waters it is anodic.

Highest possible peak voltage at the electrodes of an electrostatic precipitator is desirable to charge the flyash particles and hold them on the collecting plates.

Polyethylene sheaths of telephone cable specimens 3 ft long buckled severely over their entire length when twisted 720 degrees, but the strains incidental to most severe handling are not likely to cause rupture of the sheath.

STATISTICS



Output Week Ended Apr. 10—8,396,000,000 Kwhr

Seasonally Adjusted Index†—164.6

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Apr. 10	+4.9	+3.0	+2.9	−2.2	+8.3	+18.6	+11.2	+2.8	+6.7	−5.4
Apr. 3	+5.5	+3.9	+2.2	−1.8	+10.7	+19.9	+8.7	+4.5	+8.7	−3.6
Mar. 27	+5.2	+0.8	+1.4	−2.0	+11.6	+18.2	+13.0	+3.4	+6.7	−2.2

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load (Million Kw)	Jan.	81.1	81.2	74.9
Capacity (Million Kw)	Feb.	92.46	91.68	82.83
Production (Billion Kwhr)	Feb.	35.21	39.42	33.60
Hydro	Feb.	8.56	8.90	8.99
Fuel	Feb.	26.65	30.52	24.60
Fuel Consumption				
Coal (Million Tons)	Feb.	9.07	10.92	9.16
Oil (Million Barrels)	Feb.	5.70	8.29	6.81
Gas (Billion Cu Ft)	Feb.	75.74	67.41	57.82
Sales (Billion Kwhr)	Jan.	33.45	32.31	32.07
Residential	Jan.	10.96	9.77	9.82
Commercial	Jan.	5.79	5.60	5.37
Industrial	Jan.	14.52	14.83	14.90
Other	Jan.	2.17	2.12	1.97
Net Income Class A & B Companies ($ Million)	Dec.	105.32	84.26	101.50
Estimated Dec. '54 Peak (Million Kw)	Jan.	93.4	94.0	96.1
Kwhr per Residential Customer (12 Month Average)	Jan.	2,363	2,345	2,183
Revenue per Kwhr Residential Service (12 Month Average)	Jan.	2.74¢	2.74¢	2.77¢
Canadian Production (Billion Kwhr)	Jan.	5.63	5.72	5.66

Business Statistics

FRB Industrial Production Index†	Feb.	125*	124	136
Gross National Production Annual Rate ($ Billion)	1st Qtr.	358.5	363.5	362.0
EW 4 Industry Production Index†	Feb.	114.6	117.3	125.4
ENR Construction Cost Index††	Apr.	129.0	128.7	123.6
BLS Consumer's Price Index	Feb.	115.0	115.2	113.4
NEMA Insulation Materials Sales Index†	Feb.	120	124	177
NEMA Electric Appliance Sales Index†	Feb.	98	90	121
NEMA Household Refrig. Sales Index†	Feb.	91	95	106
Metal Prices (Apr. 13)				
Copper, Conn., V., lb		$.30	.29¾	.29¾-.30¼
Lead, N. Y., lb		.14	.13	.13
Zinc, prime Western E. St. Louis, lb		.10¼	.09¾	.11
Tin, Straits, qual. N. Y. lb		.99½	.92½	102.0
Aluminum, ingot, base price		.21½	.21½	.20½
Nickel, base price		.60	.60	.60
Steel, billets, Pitts., ton		62.00	62.00	59.00
Steel, scrap, No. 1 heavy, Pitts., ton		26.00	24.00	44.00

*Preliminary **Revised †1947-49=100 ††1949=100

Untapped Waterpower—88 Million Kw Potential

The nation's undeveloped waterpower would provide a capacity of about 88 million kw with a corresponding annual generation of 379 billion kwhr. That's according to the Federal Power Commission's latest estimate of projects potential, authorized, or under construction. Such estimates are continually under revision as further investigation reveals new sites, or the infeasibility of development of earlier ones.

Over half of this power supply lies beyond the Continental Divide with 48 million kw, and over 70% of that is in the North Pacific area, mostly in the Columbia River drainage system. Next largest areas are the Missouri River drainage system, with slightly more than 10% of the total, and the South Pacific with about 9%. On a regional basis, this makes the Pacific and Mountain areas lead the nation with a little less than 60% of the capacity, and a little more than 66% of the expected annual generation.

Region	Capacity-Mw	% Total
New England	3,233	3.7%
Middle Atlantic	6,415	7.3
East North Central	3,091	3.5
West North Central	6,389	7.3
South Atlantic	8,677	9.9
East South Central	4,168	4.7
West South Central	3,616	4.1
Mountain	21,895	24.9
Pacific	30,508	34.7
Total US	87,992	100.0

	Avg Annual Generation—million kwhr	
New England	9,864	2.6%
Middle Atlantic	24,330	6.4
East North Central	12,785	3.4
West North Central	27,002	7.1
South Atlantic	26,801	7.1
East South Central	16,960	4.5
West South Central	9,985	2.6
Mountain	95,285	25.2
Pacific	155,504	41.1
Total US	378,516	100.0

The largest concentration of water resources east of the Mississippi lies in the North Atlantic drainage area with about 8½% of the total or about 7½ million kw, while in terms of generation, it would represent about 20 billion kwhr, or a little over 5% of the anticipated annual generation.

FINANCIAL

Rule U-50 May Be Relaxed

SEC may soon loosen up the tight rein over sale of securities by registered utility holding companies and their subsidiaries

The upcoming decision on competitive bidding by the Securities and Exchange Commission may nullify a large part of the federal regulation over sale of securities by registered utility holding companies and their subsidiaries. And it looks very much as though the commission is about to take the first step in loosening up the tight federal rein over utility stock issues.

If so, those in favor of such action will owe much to the recent opinion of Federal Court Judge Harold R. Medina, dismissing as completely unproved the charges of monopoly and conspiracy filed against the nation's major investment bankers by the Truman Administration anti-trusters. This decision made it a lot easier for the present SEC to re-examine Rule U-50 it inherited.

Rule U-50 Change . . . For the time being, of course, SEC in its recent hearings was only concerned with a narrow proposal: A relatively small change in the present Rule U-50 which sets up competitive bidding requirements for all security sales by utilities.

The arguments pro and con which have been presented to the commission by investment bankers, holding companies, and other interested parties, indicate that adoption of this proposal would be regarded as only the first step in eventual elimination of the competitive bidding requirements for most if not all utility security sales.

The reason behind this is deeply imbedded in the history of the once-controversial Public Utility Holding Company Act of 1935, and the background of adoption in 1941 by SEC of Rule U-50.

The act declared that the national public interest is or may be adversely affected when holding company subsidiaries:

"Enter into transactions in which evils result from an absence of arms-length bargaining or from restraint of free and independent competition" or "when there is . . . lack of economies in the raising of capital."

Rule U-50 Adopted '41 . . . After a great deal of testimony about "banker domination", SEC in 1941 adopted Rule U-50, noting that Congress was particularly concerned about the relationship between holding companies and investment bankers. It concluded that competitive bidding was the only satisfactory way of avoiding the evils denounced by the statute.

Last November, within a few weeks after the Medina opinion in the banker anti-trust case, the Eisenhower majority on the SEC announced its willingness to take a new look at U-50. Chairman Ralph Demmler said he believed that if state regulation is adequate to protect against the evils mentioned in the Holding Company Act or (significantly) if they no longer exist, then SEC can drop its competitive bidding requirements for sale of state regulated subsidiary securities.

In the contest that followed before the SEC, 11 state commissions, 8 major investment banking firms, 7 large registered holding companies, as well as the American Bar Association, the Investments Bankers Association, and the National Association of Securities Dealers lined up in favor of the proposed rule change.

On the other side—fighting for competitive bidding—are the investment houses of Halsey Stuart & Co and Baxter, Williams & Co.

Judge Medina's Opinion Popular . . . Morgan, Stanley & Co made Judge Medina's opinion the text for its points. Main one: Banker domination does not now exist, never did, and even if it did, today's rules ought to be judged by today's conditions and not by what SEC or anybody else thought they were in 1941, 1935 or 1915.

A telling quotation from Medina's opinion appeared in almost every brief filed by those favoring the rule change.

"The myth of domination and control of issuers by investment bankers, at least in the post securities act period . . . blown up by time long-continued propaganda in favor of compulsory public sealed bidding, should perhaps be given a decent burial and quietly laid to rest."

The importance SEC attaches to the meaning of these and other words of Judge Medina is clear; in pressing Senator Wheeler for some evidence of banker domination today, Chairman Demmler said:

"What was determined as a fact at any one time is not necessarily a fact 13 years later . . . it seems to be that in first looking at restraint of competition, doubtless there would be restraint of free competition if there were in fact banker domination."

Banker Domination . . . Despite an inability of the opponents to cite any present-day examples of utility domination by bankers, they doggedly stuck to their guns, asserting that but for Rule U-50 they would have plenty of examples to cite. In the opinion of Halsey Stuart & Co, even after 19 years of living under the Holding Company Act, corporate control over the subsidiaries which would be exempted by the amendment is just as firm as it was prior to Rule U-50. In their company reply to the proponents, Halsey Stuart said:

"To imagine for one instant that the influence of the negotiating banker will not again assert itself when he has exactly the same selfish pecuniary motive which led to the passage of the act, is too much for any save the most gullible to swallow."

Thus, opponents like Halsey Stuart claim (1) "latent domination" and conditions today the same as when U-50 was adopted, (2) that private negotiation for sale of stock tends to concentrate in the hands of a few big investment houses and costs the issuing utility more, (3) that competitive bidding saves the issuer money, and (4) that most state commissions are either too weak or too indifferent to effectively regulate such transactions.

The proponents — like Morgan,

Stanley — argue that the "banker domination" theory has been conclusively disproved by the Medina decision, that opponents ignore the impact of enforcement of other holding company act provisions—like that against interlocking directors or officers on bank and utility board, that competive bidding benefits only a few underwriters and "saves" the issuer money by depriving him of special investment banker services available only on negotiated deals, that a corporation's management ought to be free to choose any financing method it thinks best, and that federal regulation ought to be decentralized.

Even when SEC acts, it may be some time before the relaxation is effective. Baxter, Williams & Co took special pains in its arguments before the commission to make clear it would appeal to federal court any final decision to adopt proposed amendment to Rule U-50.

Stock Plan . . .

. . . for employees will be voted upon by Commonwealth Ed stockholders on May 25

Stockholders of Commonwealth Edison Co will be asked to vote at the annual meeting May 25 on a proposal to establish an "employee stock purchase plan."

Under the proposal, 500,000 shares of Edison common would be offered from time to time to employees within certain limitations as follows:

- The shares offered would be original issue stock. No shares would be purchased on the open market.
- The price to employees would never be less than 90% of the market value and never less than par value ($25). On the basis of today's market price of about $39, the offering price could not be below $35.10 per share.
- The plan would be available to all regular employees who are of age, regardless of job or pay and stock purchased would be on the basis of a uniformly applied fixed percentage of regular earnings. Also, purchases would be permitted through payroll deductions.
- The plan, if authorized, could be terminated by the board of directors at any time.

(Continued on page 222)

Today in Utility Finance

YIELDS (%)

Quality	Bonds 1st	Bonds 2nd	Bonds 3rd	Preferred Stocks 1st	Preferred Stocks 2nd	Preferred Stocks 3rd	Common Stocks 1st	Common Stocks 2nd	Common Stocks 3rd
DATE 1954									
April 8	**2.84**	**2.87**	**3.14**	**3.92**	**4.08**	**4.42**	**4.79**	**5.15**	**5.38**
April 1	2.83	2.86	3.15	3.91	4.08	4.40	4.81	5.14	5.40
END OF QTR.									
1st 1954	2.82	2.87	3.14	3.88	4.09	4.42	4.83	5.19	5.42
4th 1953	3.07	3.12	3.34	4.17	4.32	4.62	5.07	5.57	5.81
3rd 1953	3.30	3.33	3.54	4.35	4.52	4.83	5.36	5.97	6.01
2nd 1953	3.34	3.46	3.64	4.47	4.70	4.88	5.52	5.93	6.10

Date: Reis & Chandler, Inc.

EARNINGS

Company	Period Months	Ended	Net Income 1954	Net Income 1953	Earnings Per Common Share 1954	Earnings Per Common Share 1953
Central Maine Power	2	Feb.	$1,034,241	$777,057	$...	$...
Iowa Electric Light & Power	12	Feb.	2,888,134	2,597,242	1.64	1.45
Pacific Power & Light	12	Feb.	4,974,932(a)	4,490,509	....	....
			1953	**1952**	**1953**	**1952**
Alabama Power	12	Dec.	$13,165,270	11,520,279	$...	$...
California Electric Power	12	Dec.	2,751,211	2,735,940	.88(b)	.89(b)
Empire District Electric	12	Dec.	1,465,960	1,384,421	2.12	1.98
Idaho Power	12	Dec.	4,502,831	3,806,238	3.35	2.75
Indianapolis Power & Light	12	Dec.	5,721,553	5,343,227	3.19	2.97
Louisville Gas & Electric	12	Dec.	5,995,666	5,380,176	3.28(c)	3.31(c)
Montana Power	12	Dec.	7,448,837	7,639,010(h)	2.62	2.69
Oklahoma Gas & Electric	12	Dec.	5,997,285	5,706,889	190	2.00
Rockland Light & Power	12	Dec.	1,263,142	1,395,095(i)	.68(f)	.71(f)
Union Electric of Missouri, consolidated	12	Dec.	16,194,477	14,886,288	1.36	1.23
Utah Power & Light, consolidated	12	Dec.	4,803,970	4,698,146	2.61	2.54
West Penn Power & subsidiaries	12	Dec.	10,845,539	10,410,193	....	....
Wisconsin Power & Light	12	Dec.	5,294,967	4,457,717	1.73(g)	1.63(g)

Notes—Figures shown for the last 13 companies have been audited; (a) Before deducting $871,491 for Provision for Deferred Income Taxes Resulting from Accelerated Amortisation; (b) Based on 2,353,551 shares outstanding at end of 1952; (c) Based on 1,500,000 shares in 1953 and 1,300,000 shares in 1952; (f) Based on 1,510,173 shares in 1953 and 1,353,053 shares in 1952; (g) Based on 2,631,392 shares in 1953 and 2,305,665 shares in 1952; (h) Before $405,080 settlement of tax claim, and (i) Before $199,416 special appropriation to earned surplus.

FINANCING

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public
WEEK OF APRIL 8-14			
Bonds			
Central Power & Light—1st mtg 3½% due 1984	$18,000	100.486%	3.10%
Southern Indiana Gas & Electric—1st mtg 3¼% due 1984	8,000	102.461	3.00
Ohio Power—1st mtg 3½% due in 1984	20,000	102.461	3.00
Preferred Stock			
West Texas Utilities—60,000 sh cum 4.40% $100 par (holders of $6 preferred can exchange present 47,370 shares of stock for new stock up to April 19 on the basis of the offering price of new stock and $110 call price on $6 difference to be adjusted by a cash payment)	$6,000	$105.00	4.19%
Long Island Lighting—200,000 sh 4.35% $100 par	20,000	100.00	4.35
Ohio Power—50,000 sh 4.08% $100 par	5,000	102.00	4.00
Common Stock			
Texas Utilities—250,000 sh	$12,500	$50.00	4.16%
Northern States Power (Minn.)—1,219,856 sh (being offered commonholders on 1-for-10 basis, record April 15 to expire May 4)	17,078	14.00	5.71
SCHEDULE FOR APRIL—MAY			**Bid Date**
Bonds and Debentures			
West Penn Power—1st mtg due 1984	$12,000	.....	April 20
Commonwealth Edison—1st mtg due 1984	50,000	.....	April 27
Utah Power & Light—1st mtg due 1984	15,000	.....	April 28
Delaware Power & Light—1st mtg due 1984	10,000	.....	May 3
Montana Power—1st mtg due 1984	6,000	.....	May 4
Wisconsin Electric Power—1st mtg due 1984	20,000	.....	May 4
Cleveland Electric Illuminating—1st mtg due 1980	20,000	.....	May 4
Consolidated Edison Co of N. Y.—1st mtg due 1984	50,000	.....	May 11
Montana Power—debs due 1979	18,000	.....	May 12
Virginia Electric & Power—1st mtg due 1984	25,000	.....	May 18
New York State Electric & Gas—1st mtg due 1984	20,000	.....	May 18
Public Service Electric & Gas—1st mtg due 1984	50,000	.....	May 26
Preferred Stock			
Northern States Power (Minn.)—150,000 sh $100 par	$15,000	.....	April 20
Arkansas Power & Light—70,000 sh $100 par	7,000	.....	April 26
Montana Power—60,000 sh no par	6,000	.....	May 4
Common Stock			
Housatonic Public Service—41,159 sh (to be offered commonholders on 1-for-8 basis, record about April 23)	.....	.....	.....
Wisconsin Electric Power—421,492 sh (to be offered commonholders on 1-for-10 basis, record about April 28)	.....	.....	.....

G.E. designs light, compact, 5 KV current transformer with high resistance to corrosion

One third smaller and lighter, the new butyl-molded, outdoor, Type JKW-3 transformer is easier to install and maintain.

Almost completely corrosion-proof, this new General Electric current transformer is the first butyl-molded transformer designed for 5000-volt outdoor application. This revolutionary design has virtually eliminated maintenance.

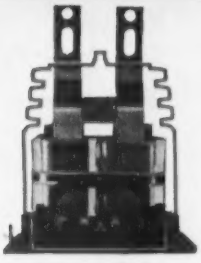
CORROSION-RESISTANT materials are used in all exposed metal parts. The case and primary bushing are butyl rubber. The butyl also serves as insulation and as an important factor in the new Type JKW-3's high mechanical strength.

EASIER TO INSTALL, this new G-E current transformer can be mounted in any position for bottom-, side-, or top-connected installations. The lightweight and smaller size facilitates installation and handling.

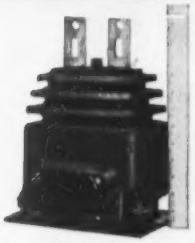
ACCURACY CLASSIFICATION of the Type JKW-3 transformer is 0.3 at burdens: B-0.1 to B-2.0. Ratings are from 10 to 800 amperes.

FOR MORE INFORMATION, contact your nearest G-E Apparatus representative, or write for Bulletin GEC-1222 to: Section 604-40, General Electric, Schenectady 5, N. Y.

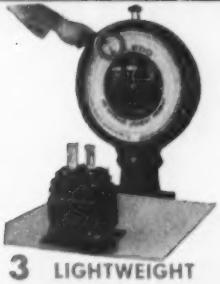
GENERAL ELECTRIC



1 BUTYL-MOLDED



2 COMPACT
only 12¾ in. high



3 LIGHTWEIGHT
only 42 lbs.

DISTRIBUTION TRANSFORMERS
different from others because.....
NEW

...Magne-valve arrester

(gapped valve-type) can be used any place on your system...regardless of short-circuit currents

Small in size and light in weight, the new General Electric Magne-valve arrester has impulse characteristics similar to those of G.E.'s modern pellet arrester—the quality standard of performance in the electrical industry. The new arrester—gapped to the bushing in the same manner as modern pellet arresters on unit-type 2400- and 4800-volt transformers—is now standard on all G-E EEI-NEMA 7200- and 7620-volt unit-type transformers.

NEW ARRESTER FEATURES:

Valve action—Thyrite* valve action is augmented by magnetic action of an internal series gap.

External gap—No 60-cycle voltage across arrester under normal operating conditions—no chance for grounding circuit if arrester is damaged.

Elimination of unnecessary breaker tripping—Unlike expulsion-type arresters, there is no short circuit during discharge and no erosion to limit the useful life of the arrester.

Small size and light weight—9-kv arrester, for 7200-volt transformer, is only 14¼" long, weighs only 10 pounds.

REMEMBER . . . all transformers are not alike . . . compare the General Electric plus features in the chart below and see for yourself.

For more information contact your nearest G-E sales office or agent, or write General Electric Company, Section 431-9, Schenectady 5, New York.

*Reg. trade-mark of General Electric Company

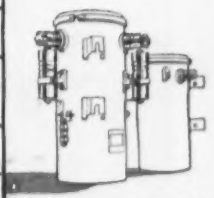
You can put your confidence in—

GENERAL ELECTRIC

ALL TRANSFORMERS ARE NOT ALIKE

(make this simple comparison and see)

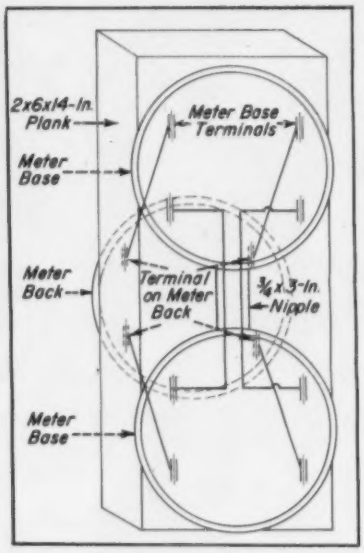
FEATURE	General Electric	Mfr. A	Mfr. B	Mfr. C	Mfr. D	Mfr. E
Production-line impulse testing	YES	NO	NO	NO	NO	NO
Nitrile rubber gaskets at all tank openings	YES	NO	NO	NO	NO	NO
Strenicor pressure terminal clamps	YES	NO	NO	NO	NO	NO
One-piece cover band	YES	NO	NO	NO	NO	YES
Terminals designed for both copper and aluminum conductors	YES	NO	NO	NO	NO	NO
Gapped valve-type arresters	YES	NO	NO	NO	NO	NO
Nationwide company-operated service facilities	YES	YES	NO	NO	NO	YES



UNIT-TYPE CONVENTIONAL

"Take your choice G. E. makes both"

SIMPLE AND NEAT in appearance is this dual meter base for checking customer complaints. Frame to take customer's meter and watthour or watthour demand meter consists of plank



TERMINAL CONNECTIONS between meter bases and back are made with No. 6 wire

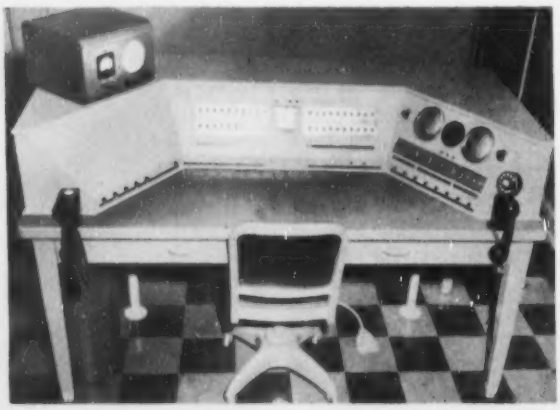
Dual Base Aids in Series Metering

RALPH FOLEY, Division Meterman, Idaho Power Co, Twin Falls

Series metering to check customer complaints is being done with a simple and inexpensive dual socket-type base on the Idaho Power Co system. The metering base will take either a watthour or watthour demand meter. It may be installed by a district service man, eliminating the need for calling in a qualified meter tester from the division office. Another advantage of using series metering for testing is that no additional bookkeeping has to be done.

The dual base measures 6 in. wide, 14 in. long, and 5 in. deep overall. It consists of the back from a socket-type meter, one meter glass cover band, and two ¾-in. meter bases. The meter bases are fastened to a 2 x 6 x 14-in. plank and are connected by a 3 in. length of ¾-in. nipple. A ½-in. diagonally drilled hole runs from each base to the meter back centered on the other side of the plank. No. 6 RC conductor is used to connect the meter terminals as shown in the accompanying wiring diagram.

In operation, the customer's meter is removed and the dual base is inserted in its place. The customer's meter is placed in either base and the check meter in the other. For normal checks, Idaho Power runs a series metering test for a period of three or four days.



RADIO SWITCHBOARD combines controls for 451.05 and 37.7-Mc systems. New 451-05 Mc control unit, shown here in temporary position on top of switchboard, will be installed in vacant panel below

2nd Radio System Eliminates Storm-Caused Congestion

T. J. BAILEY, Supervisor, Radio Communications, Wisconsin Electric Power Co, Milwaukee

A second 2-way radio system is being installed by Wisconsin Electric Power Co to eliminate storm-caused congestion on the 37.7-Mc system. Initial installation consists of two base stations (one main, one standby) and 45 mobile units in trouble trucks.

No new channels were available in the 30-50 or 153-158-Mc bands (vhf), so a channel was obtained in the 450-470-Mc band (uhf). Field tests on the 451.05-Mc channel show solid coverage of the metropolitan area, probably due to reflections from structures. In rural areas

(*Continued on page* 138)

G-E Motors Are Custom-built for Power Station Service!

OUTDOORS OR IN, General Electric power station motors are built to give you dependable, economical service. For example, the two vertical Tri-Clad* totally enclosed fan-cooled motors, shown here, have given consistent reliable performance under all weather conditions at the A. B. Paterson Steam-Electric Generator Station of New Orleans Public Service Inc.

GENERAL ELECTRIC'S 70 YEARS of experience in designing, building, and servicing motors for power station requirements assures you of getting the right motor for the job. Whatever your needs in power station motors, G.E. can furnish a complete line including dripproof, totally enclosed fan-cooled, totally enclosed air-water cooled, and weather protected motors in both horizontal and vertical construction.

FOR MORE DETAILED information on G.E.'s power station motors, contact your nearest G-E Apparatus Sales Office. *General Electric Co., Schenectady 5, New York.* 830-1

*Registered Trade-mark of the General Electric Company

GENERAL ELECTRIC

NORTH—Shakopee, Minnesota praised Northern States Power Co. for installing Form 206 fluorescents. The new lights provide superior illumination even in sub-zero weather.

EAST—Central Maine Power Co. accomplished their working objective of providing better street lighting economically by installing Form 206 fluorescent lights at Auburn, Maine.

NEW G-E FLUORESCENT STREET LIGHTS GAIN NATIONWIDE ACCEPTANCE

Are fluorescent street lights practical? Utility and municipal officials who have installed G-E Form 206 fluorescent luminaires are best qualified to give the answer. Their actual field experience, in all parts of the country, is summarized in the following questions and answers.

WHY USE FLUORESCENT STREET LIGHTING?

Fluorescent street lighting provides better visibility and a more even light distribution than the best engineered systems of either filament or mercury lamps. The low brightness of the light source reduces the glare and eye strain that accompanies other types of street lighting.

IS VISIBILITY IMPROVED?

Yes. Many lighting experts believe that fluorescent street lighting increases actual visibility by about one-third. Thus, a 1.25 footcandle level from a Form 206 fluorescent luminaire seems to provide the same visibility as a 1.7 footcandle level from filament or mercury luminaires.

IS THE COLOR OF THE LIGHT PLEASANT?

Yes. The whiter light furnished by the fluorescent lamps does not distort the familiar coloring of objects and people. Businessmen find that shoppers even come from outside usual trading areas to shop under the comfortable light from the fluorescent luminaires.

IS THE SIZE OF THE LUMINAIRE A PROBLEM?

No. The Form 206 luminaire is only slightly over six feet long and the distinctive size and shape add functional beauty to the appearance of any street or roadway. No guys or trusses are required to support the luminaire even in high winds.

WHAT MAINTENANCE IS REQUIRED?

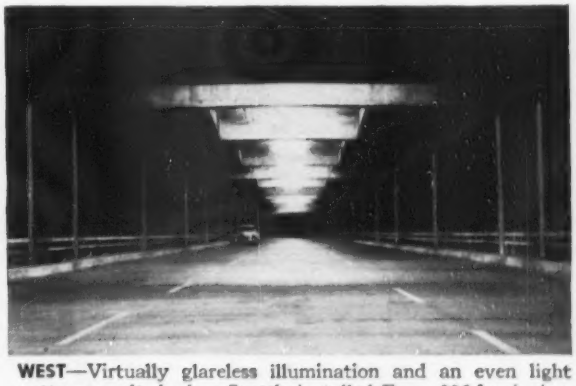
Maintenance is reduced! The fluorescent lamps used in the Form 206 have an average lamp life of 7500 hours, or about two years of street-lighting operation. The hinged plastic globe is shatterproof and is tightly sealed to prevent dirt or insects entering the unit. Sun, rain, heat, cold, or aging do not adversely affect the plastic globe or the light output.

HOW DO COSTS COMPARE?

When over-all lighting costs are computed on an equivalent visibility basis, G-E Form 206 fluorescent luminaires cost less than any other comparable system of filament or color-improved mercury. Although equipment and amortization costs are somewhat higher, installation costs are comparable, and operating costs are generally lower.

GET MORE INFORMATION about this outstanding G-E fluorescent luminaire, the Form 206. Contact your nearest G-E Apparatus Sales Office, or write Section 452-139, General Electric Company, Schenectady 5, N. Y.

SOUTH—Statesville, North Carolina installed 104 Form 206 fluorescent street lights and was enthusiastic about their visual comfort, economy, and modern appearance.



WEST—Virtually glareless illumination and an even light pattern resulted when Seattle installed Form 206 luminaires to light the second level of this new Alaskan Way viaduct.

GENERAL ELECTRIC

Radio System

(*Continued from page* 134)

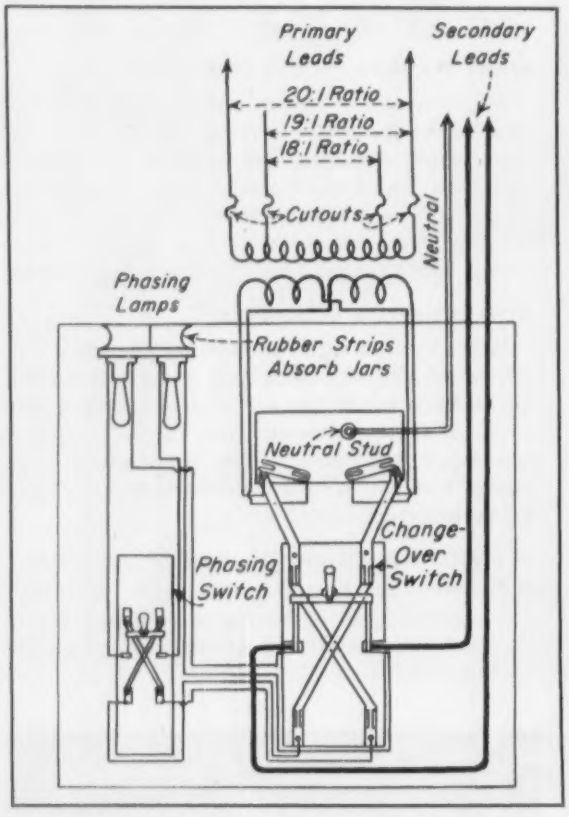
the signal attenuates more rapidly. However, coverage is anticipated within a 15-mile radius.

Multi-element, uhf antenna is mounted on a bracket on the existing tower, below the vhf antenna. Lower position is expected to be protected from lightning. The outboard bracket provides the antenna with a full-wave-length clearance from tower, guy wires, and the ground-plane rods of the vhf folded unipole antenna.

Uhf control unit is being combined with existing vhf radio in a common switchboard. Remote control unit provides 2-frequency control, if required, and remote-receiver muting over a two-wire telephone loop. Allowable telephone line loss is 20 db. Less than zero level into telephone line will modulate the transmitter to full ±15-kc swing.

Either 37.7 or 451.05-Mc channels or both simultaneously may be used from 20 dispatch points. Two-control equipment is being provided and will be arranged for instantaneous switching.

Mobile transmitter-receiver and antenna for uhf is smaller than for vhf. Mobile unit requires ac rectifier battery charger. Higher quality test equipment is needed.



PHASING AND CHANGEOVER SWITCHES must be in the same relative positions and lamps must be "out" for unit to be phase to line

SWITCHES AND PHASING LAMPS were installed on a portable transformer trailer to eliminate errors and simplify phasing and connecting

Paralleling Portable Transformer Simplified

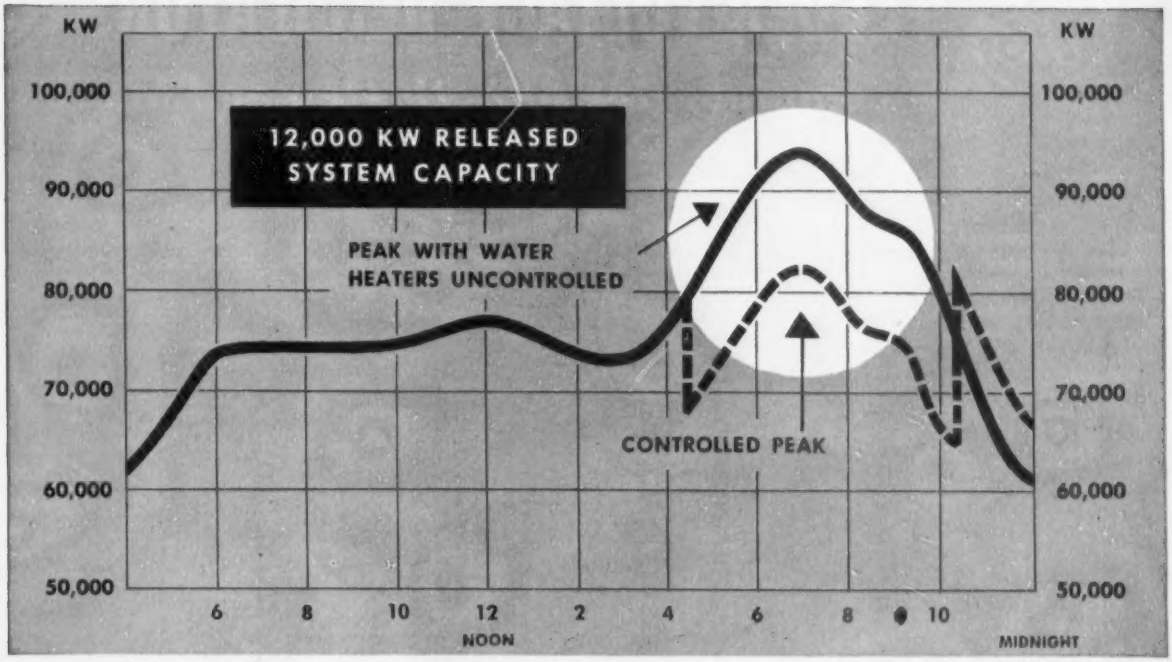
G. E. LARASON, Line Devices Specialist, Oklahoma Gas & Electric Co, Oklahoma City

Switchboards and phasing lamps installed on portable transformer trailers used by Oklahoma Gas & Electric Co facilitate phasing and connecting the portable transformer to a banked secondary bus or a three-phase transformer bank.

When paralleling a portable transformer with other transformers, change-over and phasing switches on the secondary side and the four cut-outs on the primary side are opened. A ground rod, driven close to the portable transformer, is connected to the neutral stud on the panel, which is "tied in" to the case. The neutral lead on the secondary side of the portable transformer is then connected to the secondary neutral, which places an additional ground on the case of the trailer.

Other secondary and primary leads are connected and primary cutouts are closed on the desired ratio. The phasing switch is then closed to a position which causes the phasing lamps to glow. When this position is found, either up or

(*Continued on page* 142)



DAILY LOAD CURVE SHOWS RELEASED LOAD THROUGH USE OF ECONOMICAL G-E TIME SWITCH OFF-PEAK CONTROL

Improve System Operation with G-E Time Switch Control of Electric Water Heaters

The electric water heater load, growing by an estimated 2,400,000,000 KW hours per year, is one of the few loads utility management can control for profitable load building. By automatically cutting off the electric water heaters on your system during peak periods with General Electric time switch off-peak control, you reduce the peak load and receive these benefits:

RELEASED SYSTEM CAPACITY

You can release capacity into your electrical system with time switch off-peak control equal to the number of electric water heaters on your system multiplied by 0.6 KW (average KW demand per heater).

INCREASED SYSTEM LOAD FACTOR

With time switch off-peak control, more kilowatt hours can be sold without exceeding the peak demand, and the return on your system investment is greatly increased.

LOWER INVESTMENT COSTS

To serve new water heater loads, it is unnecessary to install new capacity—your only system investment is in time switch off-peak control.

G-E TIME SWITCH CONTROL

Both of the G-E time switches, the T-43 and the TGW-2, offer low-cost, flexible off-peak control.

FOR MORE INFORMATION

Contact your General Electric Apparatus Sales Office. A representative will be glad to discuss, in terms of your needs, any one of G.E.'s off-peak control systems: combination watthour meter-time switch, 720-cycle control, or time switch. Also write for Bulletins GEC-474A and GEC-705B to Section 603-176, General Electric Company, Schenectady 5, New York.

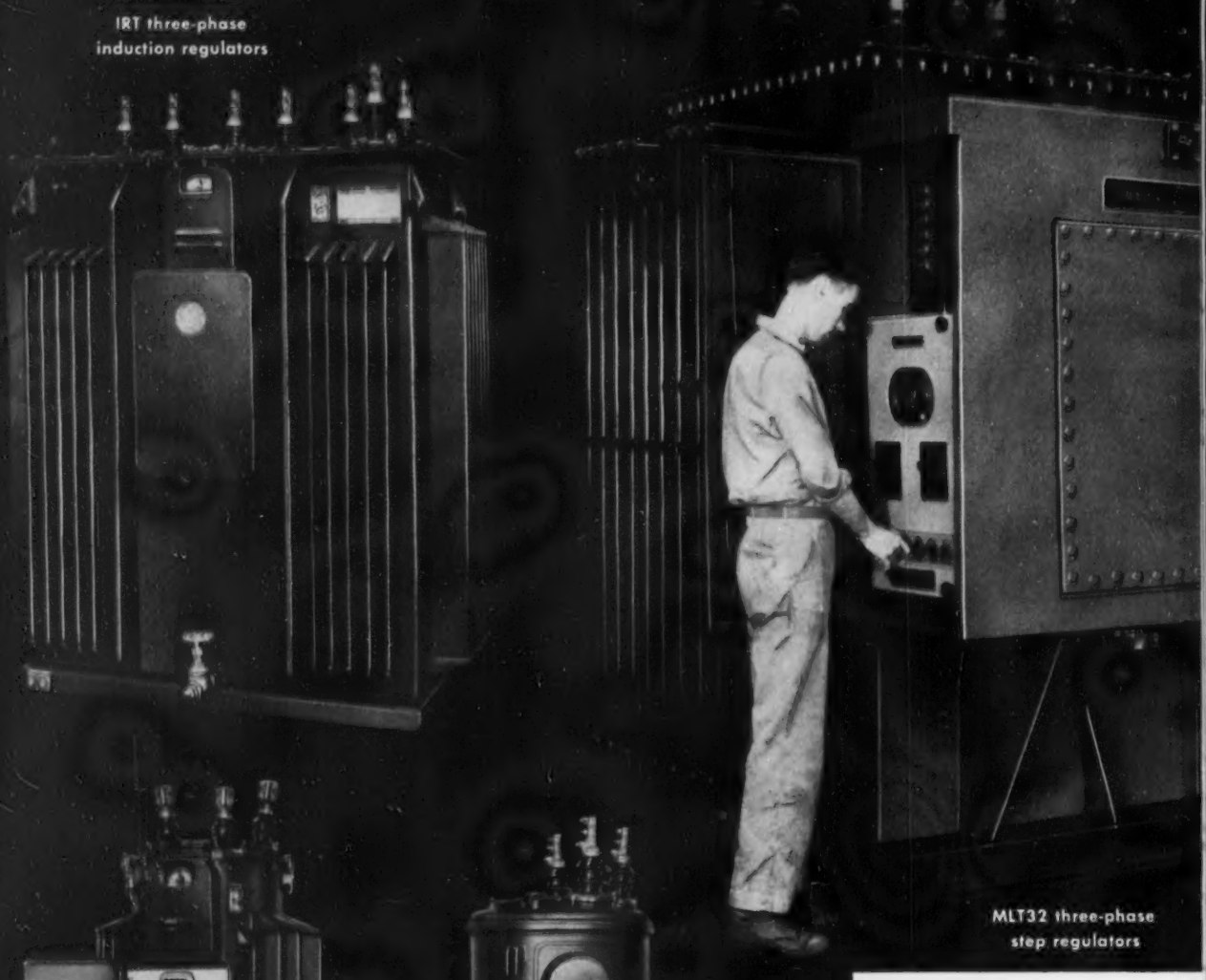
T-43 TIME SWITCH is lightweight, easily mounted indoors or outdoors; preset at factory to purchaser's schedule; available with external reset.

TGW-2 TIME SWITCH uses same base and cover as Type I-50 watthour meter; accurate setting is simplified by easily-used sealable openings.

GENERAL ELECTRIC

FEEDER VOLTAGE REGULATORS

a complete line of both step and induction



IRT three-phase induction regulators

MLT32 three-phase step regulators

IRS single-phase induction regulators

ML32 single-phase step regulators

ADVANTAGE OF CLASS 1 ACCURACY is illustrated in diagrams at right which show how a reduction in *effective* bandwidth permits a greater voltage drop in primary, transformer, and secondary while maintaining the same voltage standards from first to last consumer.

regulators with the economy of

Class 1 Accuracy at no extra cost

Whatever your voltage problem, you'll find a dependable, low-cost solution in this complete line of General Electric feeder voltage regulators.

G-E Induction Regulators, available for circuits up to 15 kv and 3000 kva, provide smooth, stepless control and need virtually no maintenance. For close regulation of single-phase feeders where operations are frequent and immediate voltage correction is required, G-E Type IRS single-phase induction voltage regulators offer the finest regulation obtainable. Their rugged operating mechanism and the elimination of switching contacts give you a maintenance record unbeaten anywhere. Type IRT three-phase induction regulators offer the same advantages of rugged construction, long life, and negligible maintenance.

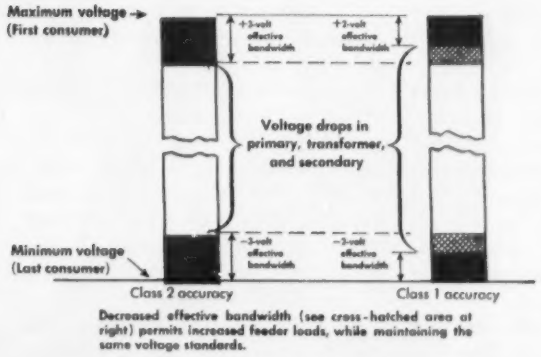
G-E Step Regulators assure dependable and economical regulation where you handle large blocks of power, and where you need supplementary regulation on your branch and rural feeders. For three-phase circuits, station-type MLT32 regulators adjust voltage in thirty-two 5/8% steps (Best suited for lines with balanced loads). They feature accessibility and ease of maintenance of switching mechanism. G-E Type ML32 single-phase step regulators also adjust voltage in thirty-two 5/8% steps, and give low-cost, dependable regulation on branch and rural circuits.

Class 1 Accuracy, the highest accuracy classification defined by ASA Standards, is a standard feature on *all* G-E voltage regulators. When compared with regulators with Class 2 or Class 5 accuracy, the G-E regulator with Class 1 accuracy permits (1) greater feeder length at the same load density, (2) greater load on existing feeders, or (3) higher voltage standards on existing feeders. Insist on Class 1 Accuracy controls. They mean *dollars* in your pocket with not one additional *cent* in investment.

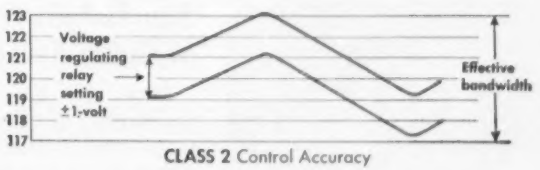
For More Information about G-E voltage regulators, contact your nearest G-E Apparatus Sales Office or authorized agent. Or write Section 423–4, General Electric Company, Schenectady 5, New York.

Progress is our most important product

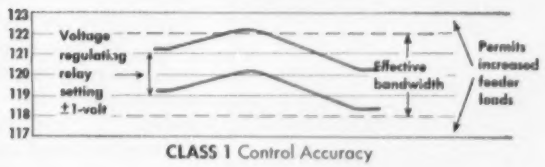
GENERAL ELECTRIC



Decreased effective bandwidth (see cross-hatched area at right) permits increased feeder loads, while maintaining the same voltage standards.



CLASS 2 Control Accuracy



CLASS 1 Control Accuracy

Portable Transformer

(*Continued from page* 138)

down, the phasing switch is closed to the opposite position, and in this position the phasing lamps on the panel should not glow.

When the proper position of the phasing switch has been found, the change-over switch is closed in the same relative position. The portable transformer is then properly paralleled with the line on which the transformer is to be removed. Considerable phasing time is saved in comparison to the former method.

Flush-Mounting Stringing Reel Saves Floor Space

Wire-stringing reels that drop flush with the truck floor are a feature of new light service trucks used by Pacific Power & Light Co. The reel saves space and facilitates handling awkward portable reels and heavy coils. Installation of the real costs $75 at the time of body fabrication. The flush-mounting reel was developed by Cecil Hudlow, PP&L's transportation supervisor.

The new trucks are being used in rural sectors of Washington and Oregon where small service crews often are pinched for manpower in emergencies. The reels will handle coils weighing up to 400 lb, whether they consist of aluminum, triplex, or copper conductor.

With the cradle reel resting flush with the truck floor, coils may be flipped onto the cradle arms and held in place by steel pegs. Pegs may be placed in any of four holes in each arm to take several coil sizes.

A lever at the back of the truck moves an eccentric which raises the reel. A movable cross-bar with two fingers guides the conductor off the reel as it is paid out. Crews also have found it practical to attach a pulley at floor level and run the conductor through it.

ACTUATING LEVER raises cradle reel from flush-mounted position for stringing of services. Reel will take up to 400-lb coil of wire; steel pegs are movable on arms to position of coils of various diameters. Movable cross bar with guide fingers keeps wire from slipping off reel

The cradle reel has proved very practical in the outlying districts where only one man often runs services. Addition of power to take up conductor or for braking on tension stringing would be a possible refinement, Hudlow believes. Another advantage would be a cage to permit stringing two or three types of wire from the same reel.

CABLE REEL STANDS keep reels several inches from the floor so that they can be moved easily with a hand truck

Stands Aids Handling of Cable Reels

Cable reel stands, made almost completely of salvaged materials, saved time and money in Central Illinois Public Service Co's storeroom. Stands keep the reels several inches above the floor so that a hand truck can be run under them; reels can be moved about the storeroom more easily.

Using the hand truck, one man can handle reels up to 4,000 lb. Two men can handle reels up to 6,000 lb. Ordinarily four or five men are required to move such reels around in the storerooms.

Material in one stand includes two 5 ft 8-in., 2-pin crossarms; four truss stands; four ⅝ x 16-in. machine bolts; and either four 2¼-in. square washers or four saddles removed from steel pins. This 32 x 36-in. stand is the one that meets most requirements. Stands up to 40 in. long are made for reels 72 in. and up in height.

With the aid of a drill press and power saw, a man can complete a stand in 15 or 20 minutes.

Don't Forget to SPECIFY REVERE

CONDENSER TUBES AND PLATES

Year after year users of condenser tubes and plates specify Revere, not only for new equipment, but when re-tubing. You might consider this fact if you are not as yet a Revere customer.

Correct specification is vitally important, because conditions vary so greatly. Each installation presents an individual combination of factors, each one of which should be studied before deciding on the proper alloy. It is often advisable to make a new survey of the situation before re-tubing, because the nature of the cooling water may have changed, or other service alterations have taken place.

To find the alloy or combination of alloys best suited to meet a specific set of circumstances, Revere offers the help of its Research Department, made available through the Technical Advisory Service. Working with the country's leading users of condensers and heat exchangers, these capable consultants have helped solve many and varied types of problems, leading to longer tube life.

Revere makes tubes and tube sheets in all the customary alloys. See the nearest Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

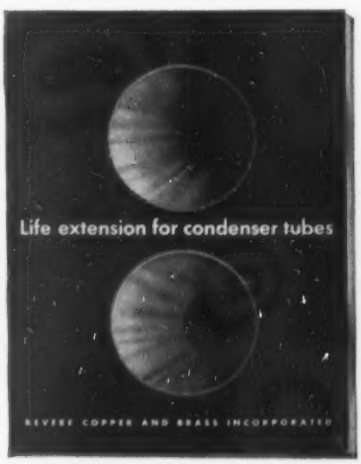
Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

SEE "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

This 28-page booklet is of unusual interest in these times when it is more important than ever to squeeze every last day of use out of condenser and heat exchanger tubes. It includes data on various copper alloys, photos of different types of condenser tube corrosion, and photomicrographs of the grain structure of different metals under varying operating conditions. Write on your firm's letterhead for your free copy. Ask for "Life Extension for Condenser Tubes."



American Standards for High-Voltage Circuit

Item	British Standard (Oil Circuit Breakers Only)					American Standard (Oil and Oilless Circuit Breakers)				
	Rated Service Volts, kv[a]	Power Freq. Test, kv	Wet Test, kv[c]	Impulse Test, kv[c]	Creep Dist. in.[c]	Rated Volts, kv[b]	Power Freq. Test, kv	Wet Test, kv[c]	Impulse Test, kv	Creep Dist. in.[c]
Standard Rated Voltages Over 3 kv and Corresponding Insulation Tests	3.3	9.5	16	.....	.....	4.16	19	.....	60	.....
	6.6	17	22	.....	.....	7.2	36[d]	30	95[d]	7.1
	11	27	30	.....	9	13.8	36	.....	95	.....
	.....	.....	.....	.....	.....	14.4	50	45	110	11
	22	52	55	150	15	23	60	60	150	17
	33	76	80	190	23	34.5	80	80	200	23
	44	100	100	260	29	46	105	100	250	30
	66	150	150	330	44	69	160	145	350	44
	88	200	195	450	59	.....	.....	.....	.....	.....
	110	250	240	550	73	115	260	240	550	66
	110	200[e]	195[e]	450[e]	73	.....	.....	.....	.....	.....
	132	300	285	630	88	138	310	275	650	79
	132	250[e]	240[e]	550[e]	88	.....	.....	.....	.....	.....
	165	365	350	730	110	161	365	315	750	92
	165	300[e]	285[e]	630[e]	110	.....	.....	.....	.....	.....
	220	485	460	1050	147	230	485	445	1050	135
	220	400[e]	385[e]	890[e]	147	230	425[e]	385[e]	900[e]	114[e]
	275	485[e]	460[e]	1050[e]	184	287.5[f]	485[e]	445[e]	1050[e]	135[e]
						330[f]	555[e]	555[e]	1175[e]	170[e]
Standard Freq.	50 cps					60 cps				
Permissible Ambient Temp.	40 C Peak 35 C Av for 24 hr					40 C Continuous 55 C Continuous for silver-surfaced contacts in enclosures				
Permissible Temp. Rise of Contacts and Oil at Rated Current	40 C for some breakers rated 800 amp or less (50 C if silver surfaced.) 50 C for all others					30C (35 C permitted for air circuit breakers in standards now under consideration.)				
Standard Interrupting Ratings (Breaking Capacity)	Symmetrical Mva 15 350 3500 25 500 5000 50 750 7500 75 1000 .... 100 1500 .... 150 2500 .... 250 ... . Standards also require that an asymmetrical rating be shown on the nameplate. Value of this rating is not specified, but 125% of the symmetrical rating is commonly used. See BSS-116 Tables 1 & 2 for details of each rating.					Symmetrical or Asymmetrical Mva ... . 3500 25 500 5000 50 .... 1000 10000[f] 100 1500 15000[f] 150 2500 25000[f] 250 .... See ASA-C37.6 Tables 1, 2, & 3 for details of each rating.				
Calculation of Short Circuit Current at Contact Separation	$I = \frac{E}{X}$ Symmetrical $I = \frac{E}{X} \times 1.25$ Asymmetrica where I = Fault Current E = Phase-to-Neutral Volts X = Equivalent Y Phase Reactance to the Fault					By Simplified Calculations:[g] $I = \frac{E}{X} \times \phi$ Symmetrical or Asymmetrical Where ϕ is determined thus: Interrupting Time of Breaker Cycles / ϕ Fault at Generator Voltage / ϕ Fault Fed Thru Transformers 8 1.1 1.0 5 1.2 1.1 3 1.3 1.2 2 1.4 1.3 More rigorous calculations should be used where required				

These data have been compiled by the Subcommittee on Power Circuit Breakers of the American Institute of Electrical Engineers Switchgear Committee and have been reviewed by a group of recognized British circuit breaker engineers. These data supersede ERS No. 52-29 (EW, Dec 15, 1952). Proposal to replace the American bases of rating (opposite page) by a single rating was presented in AIEE paper No. 54-134 by the same subcommittee and will be interpreted further in Electrical World, May 2.

SOURCES: For British Standard (BS) circuit breakers the information has been drawn from BS 116; 1952.

For ASA circuit breakers the information has been drawn from ASA Publication C37.4-1945 through C37.9-1945 as revised through 1952, supplemented by NEMA publication 46-116 as revised through March 1953, and by papers on "Simplified Calculation of Fault Currents" published in the AIEE *Transactions*, Vol. 67, 1948.

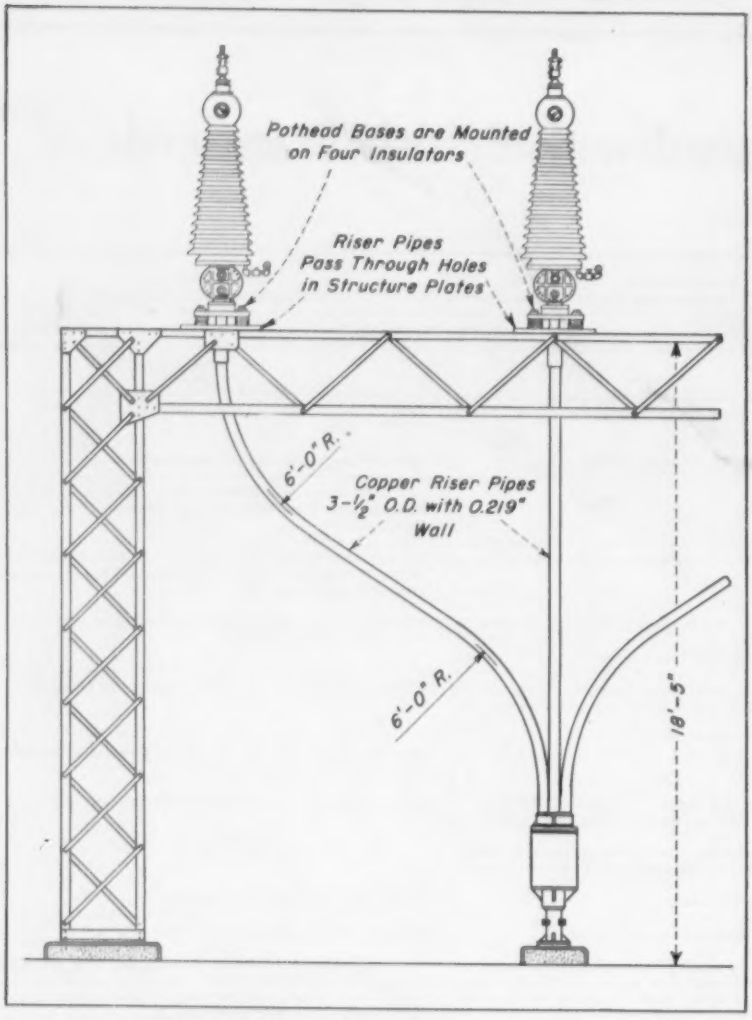
Breakers Compared with British Standards

Item	British Standard (Oil Circuit Breakers Only)	American Standard (Oil and Oilless Circuit Breakers)
Rated Circuit Breaker Interrupting Capacity	Symmetrical: The rms value of the ac component of that current which can be interrupted at a given voltage, simultaneously in all poles. Asymmetrical: The rms value of the combined ac and dc components of current at a given voltage by any one pole of a circuit breaker. Current is measured at time of contact parting.	Total RMS: The rms value of the total current, with or without the dc component, which can be interrupted at a given voltage. Current is measured at time of contact parting.
Rated Interrupting Time	Not Specified	Specified for each circuit breaker rating to be 8, 5, or 3 cycles from the time of energising the trip coil to the time of circuit interruption.
Rated Making Current	Crest Value of 2.55 × I* of a sinusoidal wave measured at instant of peak. RMS Value not specified, but becomes 1.51 times I for wave described for Crest Value. *I = Rated RMS Symmetrical Interrupting Current	Crest Value not specified, but becomes 2.70 times Rated Maximum Interrupting Current, for a sinusoidal wave having an rms value specified below. RMS Value = 1.6 (1.5 for 3-cycle breakers) times Rated Maximum Interrupting Current[h].
Rated Latching Current	Same as Making Current, but purchaser must specify whether the the breaker is to latch or to be tripped with no intentional time delay upon making.	RMS Value of 1.0 times Maximum Interrupting Current[h].
Rated Short-Time Carrying Current	Momentary Current not specified. Reference may be made to Rated Making Current. Where ratio of interrupting current to normal current is 40 or less, 3-sec current is not less than Rated Breaking Current*. Where ratio of interrupting current to normal current is greater than 40, 1-sec current is not less than Rated Breaking Current*. *Integrated over the period of test.	Momentary current is 1.6 (1.5 for 3-cycle breakers) times maximum interrupting amperes[h]. 4-sec current equal to maximum interrupting amperes*[h]. * Current measured 1 sec after start of test.
Normal Frequency Recovery Voltage Three-Phase	Up to 500 Mva: Not less than 95% rated voltage. Above 500 Mva: As near to 100% as practicable for the testing plant, and in any case for ratings up to and including 1500 Mva, not less than specified values which correspond to about 500 Mva ratings. Above 1500 Mva: Subject to agreement.	A tolerance of 15% where limited by test equipment. Where rating exceeds testing power available, tests are made to the limit of available power. Beyond these values, unit tests or other indirect tests are used. Indirect tests are supplemented by field tests when possible.
Recovery Voltage 1-Phase	1.5 × E	Not specified.
Power Factor	Up to 500 Mva: Not more than 0.15. Above 500 Mva: Not more than 0.30.	Not specified.
Operating Duty	B — 3 Min-MB — 3 Min-MB MB = Make-Break	CO — 15 Sec — CO Except 25 Mva rating, which uses CO — 2 Min. — CO CO = Close-Open
Test Schedule	% Rating 10%: B — 3 Min — B — 3 Min — B 30%: B — 3 Min — B — 3 Min — B 60%: B — 3 Min — B — 3 Min — B 100% Sym: B — 3 Min — MB — 3 Min — MB 100% Asym: B — 3 Min — B — 3 Min — B	No formal schedule specified in standards. However, certified test records are kept on file and are available for inspection by prospective purchasers. Tests are made to prove zero to 100% of rating on symmetrical and assymmetrical currents. Performance on magnetising and line charging currents also determined by test.

a. Maximum of plus 10% allowed on all ratings of circuit breakers in operation.
b. Maximum of plus 14% at lower voltages and 5% at higher voltages allowed in operation.
c. Applies to outdoor breakers only.
d. These values apply to magnetic air breakers, which predominate in this voltage class. Standard values for oil circuit breakers are 26 kv and 75 kv respectively.
e. For effectively grounded systems.
f. Ratings listed in schedule now in circulation for approval.
g. See, "Simplified Calculation of Fault Currents", AIEE *Trans.*, Vol. 67, 1948.
h. For many ASA breakers, maximum interrupting current is substantially higher than rated interrupting current at rated voltage, this can result in latching currents equal to or greater than those of corresponding British breakers.

Insulators Prevent Riser Pipe Currents

JOHN C. PARKER,
Supervising Engineer, Memphis Light, Gas & Water Div, Memphis


Pothead Bases are Mounted on Four Insulators
Riser Pipes Pass Through Holes in Structure Plates
6'-0" R.
Copper Riser Pipes 3-½" O.D. with 0.219" Wall
6'-0" R.
18'-5"

MOUNTING POTHEADS ON INSULATORS prevents undesirable circulating currents in the pipe of pipe-type cable and permits testing pipe coating resistance and locating holidays

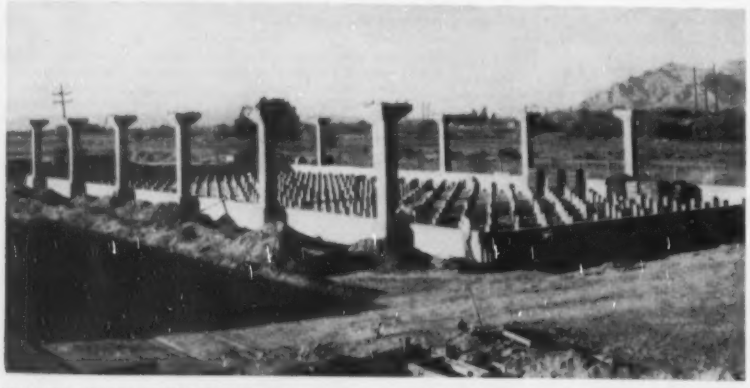
Insulating the pipe of pipe-type cable from the steel supporting structure at the 115-kv pothead prevents undesirable circulating currents in riser pipes on the Memphis Light, Gas & Water Div system. Insulators were originally installed under the pothead bases to permit isolating copper pipes from ground for periodic tests of pipe coating resistance and location of holidays.

In the initial installation, bases of potheads which were secured to the pipe risers were mounted on four insulators. A 4/0, copper cable connected the pothead base to a 500-MCM, copper, ground loop on the structure. The loop was connected underground to the cable's spreader head and to the ground connection of adjacent lightning arresters. This was done to minimize impedance from pothead base to arrester base.

When the circuit was energized, circulating current in riser pipes was found to be 75% of the load current. It was, therefore, necessary to remove the connections between pothead bases and ground loop because excessive circulating currents in pipes were more undesirable than resulting increase in impedance from potheads to arresters.

Since potheads were insulated from the steel structure, it was not necessary to remove grounds connections to the structure.

Fan Motor Support Will Cut Vibrations



FORCED-DRAFT, TWIN-FLOW cooling tower will be built for fourth unit at station

Elimination of injurious fan and shaft vibrations is basis for new design of forced-draft, twin-flow cooling tower now being installed at DeMoss-Petrie Station of Tucson Gas Electric Light & Power Co. Twelve steel-reinforced concrete pedestals adjacent to tower wall will support motor and gear reducer units to drive fans.

Secondary benefits of new design are reduction of drift loss to 0.2% maximum and savings in required ground space. In addition, chimneys on tower will tend to raise water vapor above switching structures.

(*Continued on page* 151)

This factory within a factory puts real sense in product control

Identical porcelain in two different kinds of insulators may, for example, show considerable variation in strength, because some insulator shapes are "kinder" to porcelain than others. This, of course, we must know and must control by tests of these shapes. But, many basic characteristics of porcelain are best studied in "native" form -- studied purely as a material with the fewest possible external influences.

This conception of material control started our Experimental Porcelain Laboratory. It makes just one thing, test samples -- small standard mechanical test bars, puncture specimens, and other simple basic shapes, all of uniform dimensions, so that observed variations must be in the material, itself, not affected by design. Other sections of the laboratory work with glazes, vitrification cycles, or any other factor that may bear on product or process improvement. Since its production is thus limited, it is possible to have an entire miniature porcelain plant within a single department.

Here, new ideas can be tried and experiments made without disrupting regular factory production. And, equally important, constant watch is kept over our present product; maintaining what we have until we discover something better.

Getting right to the core of material control -- not being misled by confusing factors -- is one of the most practical applications of O-B's Technical Competence. It's part of knowing our job and then *doing it well and continuously.*

You can't see "TC" on the outside of an O-B insulator -- it's on the *inside* -- but it is clearly an extra ingredient that you get at no extra expense. In fact, the day will come when, in terms of service life, it will make the product actually cheaper. The facilities and highly trained manpower to implement this very tangible extra -- Technical Competence -- have been, and will continue to be made possible by the business volume resulting from your purchase of O-B insulators.

OHIO BRASS COMPANY, MANSFIELD, OHIO
In Canada—Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

TECHNICAL COMPETENCE the heart of every *Ohio Brass* insulator

TC

Getting below the surface of the surface-leakage problem

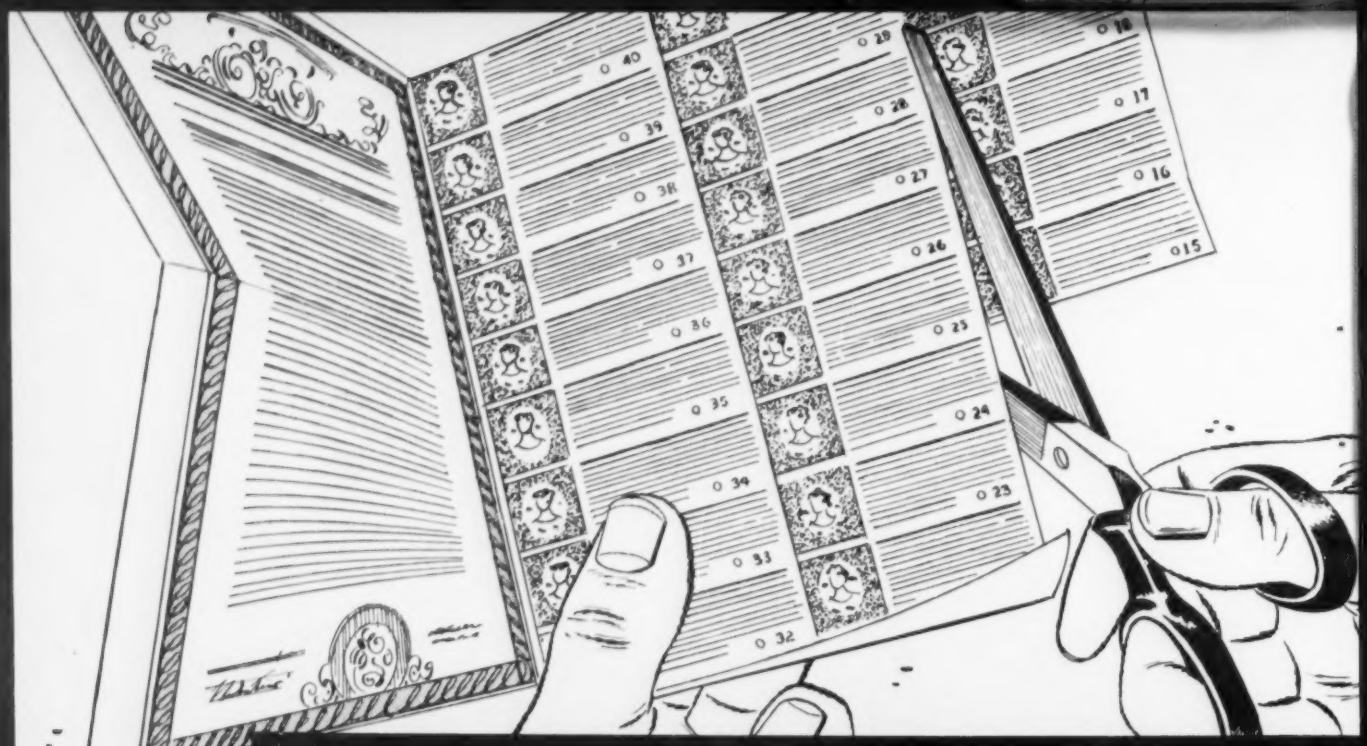
What are the *facts* about electrical surface-leakage over insulators? Is it controlled effectively by basic shape? Can the elements of insulator design and natural contamination be correlated? In other words, what's it all about?

For many years a miscellaneous assortment of insulator types and sizes has been exposed to severe industrial contamination in the outdoor test yard of our High Voltage Laboratory. All specimens are under continuous electrical potential. But, mere observation of results is not enough -- we want to study *causes* -- so each individual unit is connected to its own leakage-recording instruments in the Laboratory. Here, a continuous record is made of normal and abnormal behavior. Accurate weather observations are a part of this record. Designs speak for themselves, beyond the influence of preference or prejudice.

We have now been guided to some definite design and surface-leakage relationships. As time goes on, more facts will reveal themselves. We can't influence the results, but the results can -- and when conclusive, do -- influence us.

Continuity of testing such as this naturally implies the long background of basic and practical research that characterizes the O-B Laboratory. While, in size and facilities, this Laboratory stands first in the Insulator Industry, this is of minor importance compared to the experience and intelligence of men who interpret test results into better processes and a constant improvement of the product. It emphasizes just once more the fact that, while machinery and factories may be the mechanism of an insulator, Technical Competence is the heart of it!

the heart of every *Ohio Brass* insulator



How to get Maximum Interest Rates on your station insulator investment

You, as a buyer of station insulators, are investing your company's capital. If you were dealing in stocks and bonds rather than insulators, you would evaluate "market value" against "annual return."

Between one make of insulator and another, the cost of buying them does not vary materially. But, can this be said about the cost of *owning* them? If one lasts longer than another, its "interest" on invested capital is greater.

In the "standards-plus . . ." category of station insulator characteristics, O-B's attention to seemingly insignificant details has put extra years into the product -- witness the scores of 30-year-old installations, and hundreds in the 20-year bracket. Those have *proved* to be good investments, as they have given a high rate of return on a capital expenditure.

After all, there *are* bargains in station insulators -- not bargains in first cost but definite bargains in *what you're getting for your money*! When you look at station insulators as a capital investment, you will get the best "interest rate" with O-B.

Ohio Brass

MANSFIELD OHIO • U. S. A.

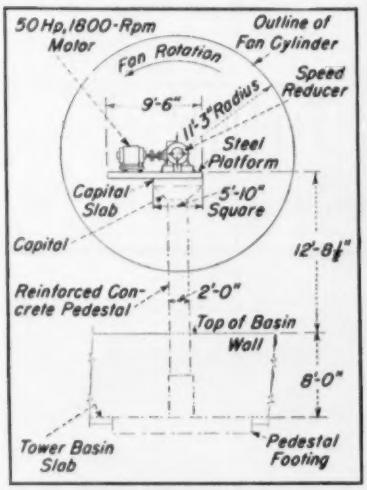
IN CANADA—CANADIAN OHIO BRASS CO. LTD • NIAGARA FALLS • ONT.

4410-H

Support

(*Continued from page* 146)

New cooling tower for fourth unit at the station measures 84 ft wide, 181 ft long and 61⅔ ft high. Capacity of six-cell tower is 46,000 gpm. Six 12-bladed fans located on each side of tower are each 264 in. in dia. They will rotate in vertical plane instead of in customary horizontal



CONCRETE PEDESTAL is designed for 6,350-lb equipment load, 3,000-lb wind load, and additional 9,000-lb load of broken fan

position at the top. Made of aluminum alloy, fans will run at 162 rpm through speed reducers driven by 1,800-rpm, 50-hp, 440-v, three-phase motors.

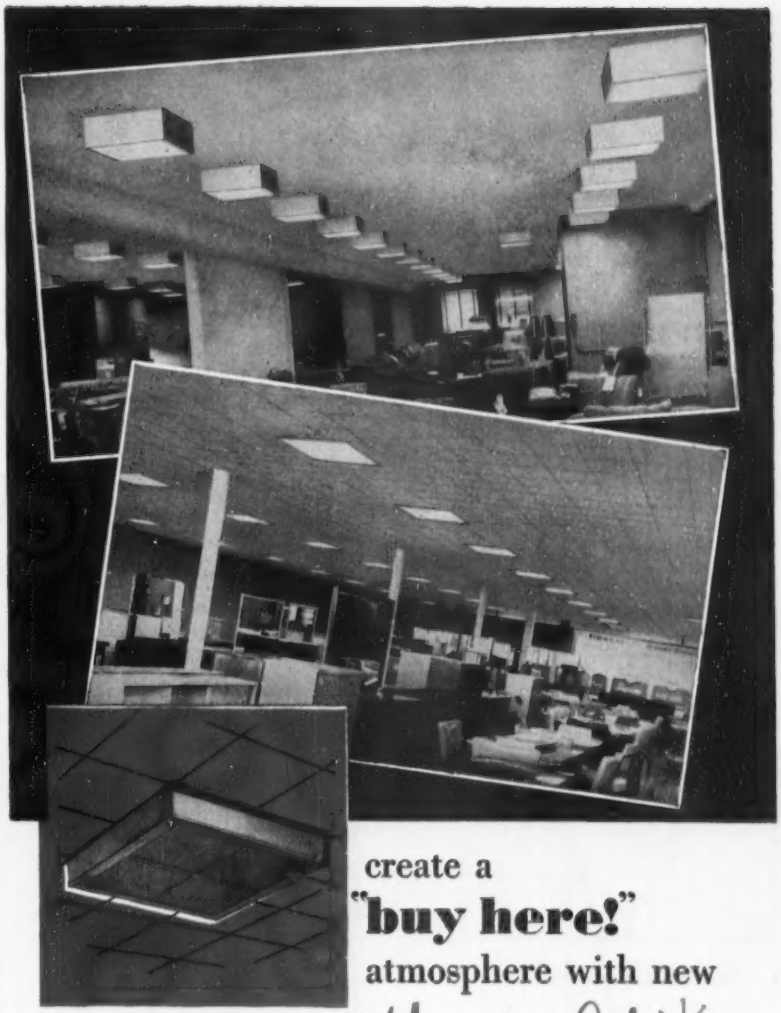
Concrete pedestals rise almost 15 ft above and rest on their own foundations outside of basin wall. Column measuring 2-ft square supports capital slab 5-ft square on which a 9.5-ft cantilever steel-beam platform will be placed.

Driving motor will be located on overhang of platform. Gear reducer will be located over center of capital slab but will project over tower wall side of the slab. Pedestal structure is designed to support a 6,350-lb equipment load, a 3,000-lb wind load with an additional loading of 9,000 lb in case of fan blade breakage.

Proper "Tools" Add to Battery Life

Proper instruments, tools, and supplies increase lead-battery life and improve performance, says Gould-

(*Continued on page* 154)



create a
"buy here!"
atmosphere with new

Guth Magic-lite* with **GRATELITE**** Louver-Diffuser

the magic combination of architectural beauty and sales-building lighting for contemporary store interiors.

GUTH MAGIC-LITE is well-shielded by a GRATELITE Louver-Diffuser. It transforms the direct light into softly flattering illumination, essential for good merchandising.

LOW ORIGINAL COST—LOW UPKEEP COST
Uses least expensive lamps—GrateLite Louvers are cleaned in 2 minutes.

VERSATILE
Mount singly or in patterns. Recess or surface. 24" or 12" square sizes.

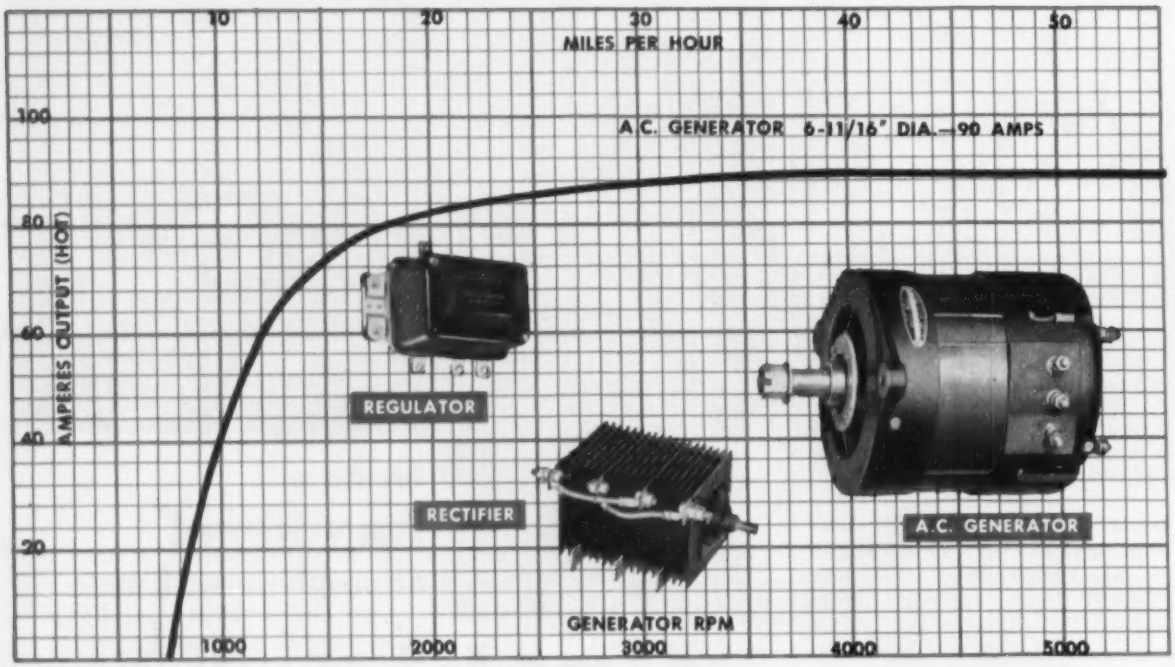
*Trademark
**U. S. & Can. Pats. Pend.
Trademark Registered

May we send you our new Magic-lite Catalog 901-H?

THE EDWIN F. GUTH CO. ST. LOUIS 3, MO.
Leaders in Lighting since 1902

Power Packed and

HERE'S THE A.C. ANSWER TO EXTRA-HEAVY ELECTRICAL DEMANDS



DELCO-REMY

A. C. Generator, Regulator and Rectifier

Here's the answer for "problem" vehicles—Delco-Remy's new long-lived A.C.-D.C. charging system! It's specifically designed to meet the *extra*-heavy electrical demands of public utility trucks and other vehicles equipped with two-way radio, floodlights or any extra electrical units . . . ample current reserve picks up discharged battery quickly in operation. Delco-Remy A.C. generators are suitable for use at all engine speeds.

With output ranging from 30-40 amperes at curb idle and up to 90 amperes at higher engine speeds, the new Delco-Remy A.C.-D.C. charging system meets all electrical needs under the toughest operating conditions. Included in the new system is the A.C. generator, a matching regulator, and a rugged, dependable dry-plate rectifier which converts generator A.C. output to direct current.

Application packages complete with installation instruction sheets for popular makes of cars and trucks are now available. The conversion job is simple. For further details and application data, see your nearest United Motors distributor.

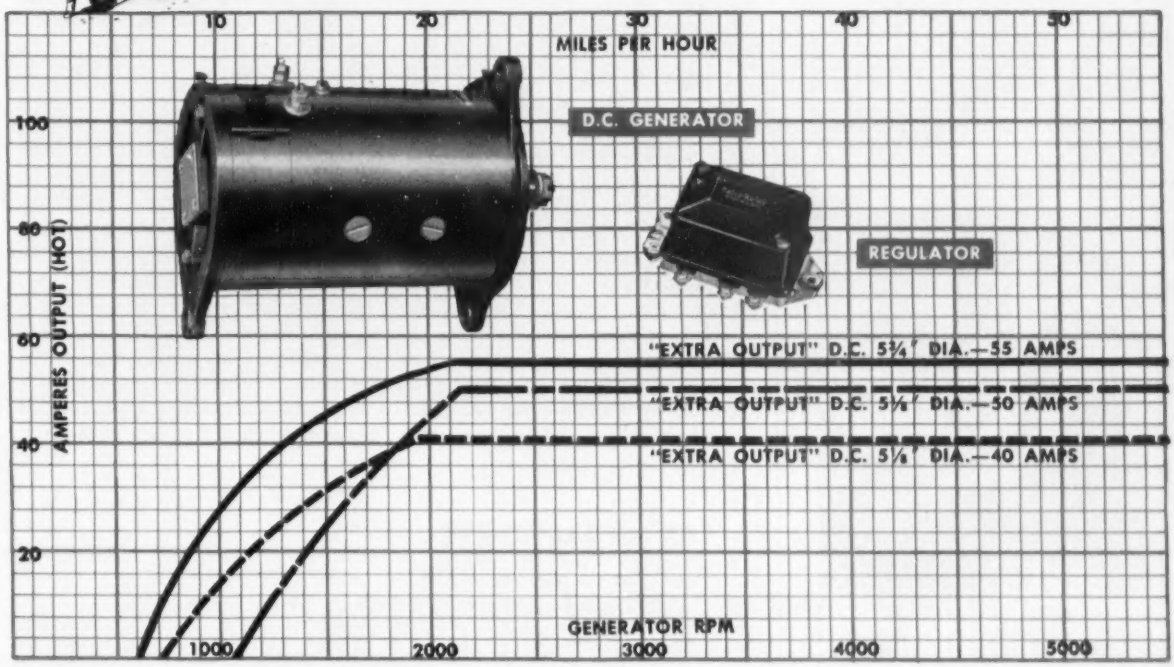
A GENERAL MOTORS PRODUCT A UNITED MOTORS LINE

DISTRIBUTED BY WHOLESALERS EVERYWHERE

WHEREVER WHEELS TURN OR PROPELLERS SPIN

Right for the Job

HERE'S THE D.C. ANSWER TO HEAVY ELECTRICAL DEMANDS



DELCO-REMY

Extra-Output D. C. Generators and Matching Regulators

Delco-Remy extra-output D.C. generators are an economical answer to the electrical needs of public utility pickup or panel trucks as well as other vehicles with additional lights, two-way radios, or other special electrical equipment in medium to heavy-duty service. Delco-Remy extra-output D.C. generators are low in cost, simple to install, economical to maintain.

DELCO-REMY 40-AMP GENERATOR has low cut-in, about 7 mph, charges from 11 to 17 amperes at curb idle . . . full output about 18 mph —for vehicles customarily used in heavy traffic.

DELCO-REMY 50-AMP GENERATOR has slightly higher cut-in, about 11 mph . . . full output about 21 mph—for vehicles customarily operated at higher speeds, with minimum slow driving.

DELCO-REMY 55-AMP GENERATOR has very low cut-in, about 6 mph; charges at curb idle from 20 to 30 amperes . . . attains full output at 20 to 25 mph—for vehicles customarily operated at low speeds with added electrical loads, such as city taxicabs and police cars.

For further details and application data, see your nearest United Motors distributor.

Delco-Remy

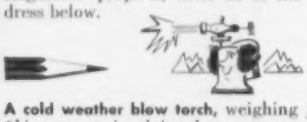
DIVISION, GENERAL MOTORS CORPORATION, ANDERSON, INDIANA

WHEREVER WHEELS TURN OR PROPELLERS SPIN

what's NEW in Engineering

A carbon dating process developed by the University of Manitoba is said to make it possible to date – within 10 years of actual age – any matter containing radioactive carbon from as far back as 40,000 years. A liquid scintillator is used. The material to be dated is incorporated in the liquid. There it sets up light flashes which are measured by an electronic eye. The sample is destroyed in the testing process.

Pre-cast, tilt-up walls, soil testing and analysis, uniform spacing of bays and a dead level roof all played important roles in Kaiser Engineers' research, design and construction of Westinghouse's newest – and largest – commercial lighting fixture plant. The result: a building suited in every respect for its intended purpose, and one constructed at an unusually low cost per square foot. For further information on this and other major Kaiser Engineers' projects, write us at the address below.



A cold weather blow torch, weighing just 6½ ounces, is claimed to operate efficiently at temperatures down to –70F. The torch pre-heats its own combustion air and a separate tank supplies fuel.

Widely diversified engineering talents and experience are available to every Kaiser Engineers' project. Departments include civil, structural, electrical, mechanical, architectural, process and production, mining and geology, metallurgical and chemical – and all work closely together. Call or write to Kaiser Engineers Division of Henry J. Kaiser Company, Kaiser Building, Oakland 12, California.

Battery Tools

(*Continued from page* 151)

National Batteries, Inc. Maintenance material includes hydrometer, thermometer, voltmeter, wire brush, rags, baking soda, mineral grease, and distilled water. Additional material for repair includes annular drill, cell pullers, putty knife, lead burner, molds, sealing compounds, and acid.

Hydrometer is used to indicate cell charge. This reading should be corrected for temperature by a thermometer. Properly recorded readings taken over life of each cell give warning of sulphation in time for corrective steps. Thermometer will indicate temperature rise during charging. Voltmeter, used to check cells or battery, will detect malfunctions.

When cleaning a battery, remove corrosion from metal parts with wire brush or knife. Coat exposed metal with mineral grease or vaseline. Wipe up spilled water or electrolyte with rags or waste. Neutralize spilled acid with baking soda.

Keep distilled water in convenient containers. Maintain proper electrolyte level by adding water. A glass-tube level gauge aids in measuring electrolyte level of the cells.

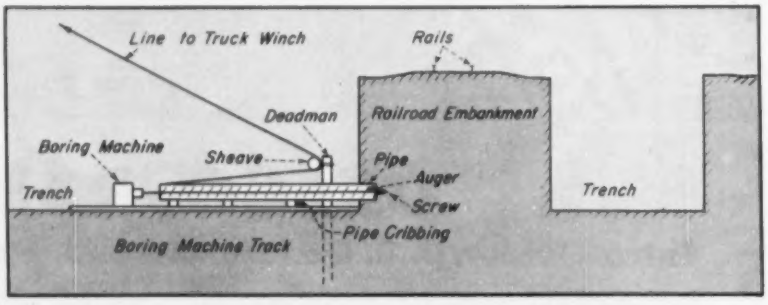
To remove a cell, first remove intercell connectors with an annular drill. Connectors may also be removed by drilling into post ⅜ in. with 15/16-in. drill, or by cutting connector with metal saw and leaving half on post.

Remove sealing compound with warm putty knife. Screw cell pullers onto cell posts and place piece of wood through loops to pull cell.

Use cell pullers also in replacing a cell. Reseal cell with sealing compound, heated and poured with proper equipment. Use acetylene or carbon-arc burner to restore connectors. Build up posts, using mold. If connector has been sawed, use splicing mold to rejoin.

To repair damaged batteries completely, hold-down clips aid in removing element from cell case. An L-shaped tool aids in removing a cover. A sturdy table with non-metallic top is useful. Use separator tools to remove and install separators.

Battery-grade sulphuric acid should be available when repaired cells must be refilled. Suitable vessels and charts help prevent damage to personnel and batteries when mixing new electrolyte.



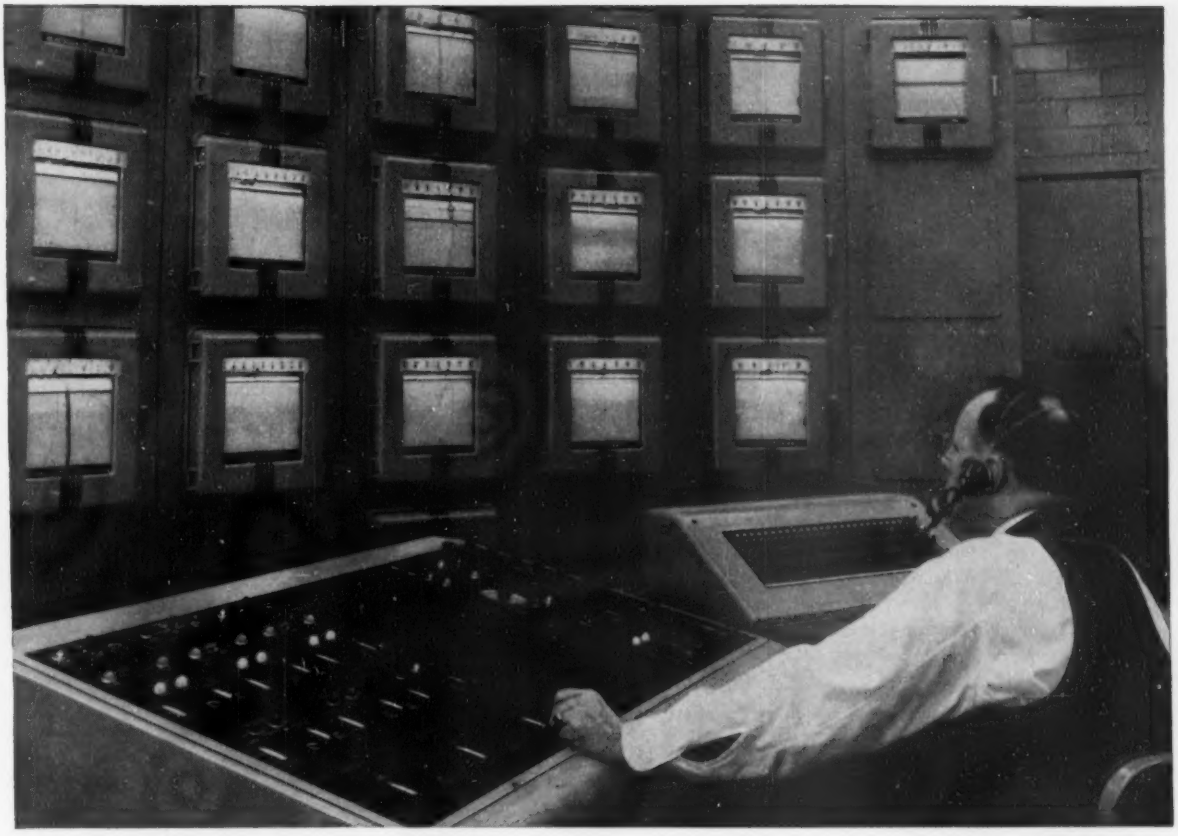
Steel Pipe Prevents Auger Deflection

Using a section of steel pipe to guide an auger solves the problems of auger deflection when boring under streets, railroads, and similar places. Pipe selected for this job has ½ in. larger inside diameter than the auger.

The auger is slipped through the pipe with the boring machine at one end of the pipe and the auger extending just beyond the other end of the pipe. A pole stub is "set" in the trench at the beginning of the boring job. A sheave is fastened to the stub, and a winch line is run from the end of the steel pipe, through the sheave, and back to a winch on the truck.

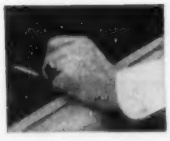
As boring proceeds, tension is maintained on the winch line to keep the pipe following closely behind the auger. Dirt comes back out through the pipe.

Rigidity of the pipe prevents it from being deflected easily when it strikes obstacles. Holes can be bored straight and with precision so that they come out within a very few inches of the objective set when the boring is started.



Jrl. Ad ND4-56-461(14)

Picture of a confident system supervisor...



. . . confident because, with a touch of his hand, he selects an electronically-calculated answer to any load-frequency operating problem which his system is apt to encounter. For his L&N Load-Frequency Control Console embodies the accumulated judgment of system operating engineers throughout the country. These engineers are the men in more than 300 control installations who have worked with—and contributed to—L&N Load-Frequency Control in the past quarter century.

Thus, when you apply L&N Load-Frequency Control to your system, you're assured of a control that meets all known requirements including: characteristics of the various generating units, overall area requirements, interchange contracts, and parallel operation with load-frequency control equipment in neighboring systems. And you have flexibility—your control console can be readily "tuned" to changing conditions such as a frequently revised incremental loading schedule.

Also, L&N Load-Frequency Control gives you and your power neighbors stronger ties—better working cooperation, and an actual increase in the effective use of tie lines. Thus, you get the full benefit of interconnected-system operation.

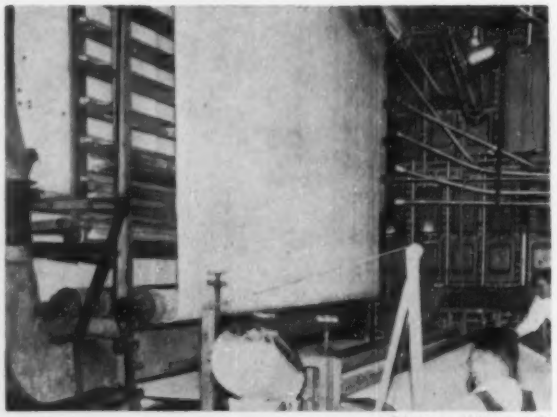
You'll appreciate the extent of utility-L&N teamwork when you discuss your needs with our Field Engineers. Contact 4938 Stenton Avenue, Philadelphia 44, Pa.

Latex Drying and Curing Hastened by Infrared Heat

Drying and curing liquid latex backing on loop rugs have been speeded at Patcraft Rug Mill, Dalton, Ga. by a double-pass infrared oven using 70 electric radiant heaters. Latex is now dried evenly and thoroughly at speeds of from 8 to 20 ft per min, depending on material thickness. Rugs can be cut immediately and sent on to be dyed and finished.

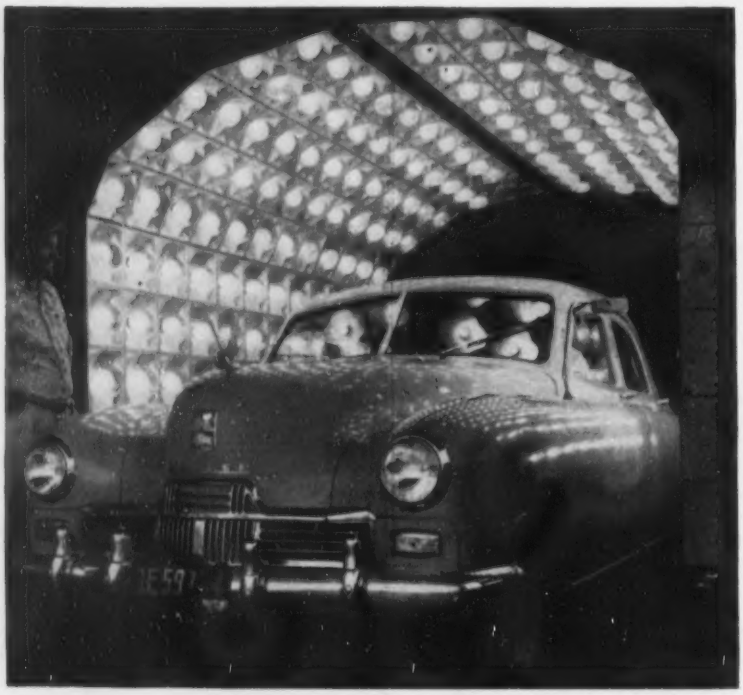
As a space-saving measure, the heaters are set up in two vertical banks to provide intense, uniform heat to coated side of web as it travels up and down through oven. Closely spaced heaters bring work quickly up to drying temperature, while others spaced farther apart accurately hold drying temperatures through remainder of oven. Total heater load is 225 kw.

Heaters are mounted on frames attached to rollers so that assembly can be withdrawn from work during starting and stopping periods. A blower provides circulation through oven, exhausting moisture-laden air. This procedure helps to decrease drying time.



Edwin L. Wiegand Co

CURING AND DRYING liquid latex coating on loop rugs in radiant infrared oven speeds production. Thorough and even drying is done at speeds from 8 to 20 ft per min.



CAR WASH owner Frank Pasquale is well satisfied with the infra-red oven in his production line. The 81-kw installation has upped production to 400 cars per day

Infrared Oven Speeds Car Washing

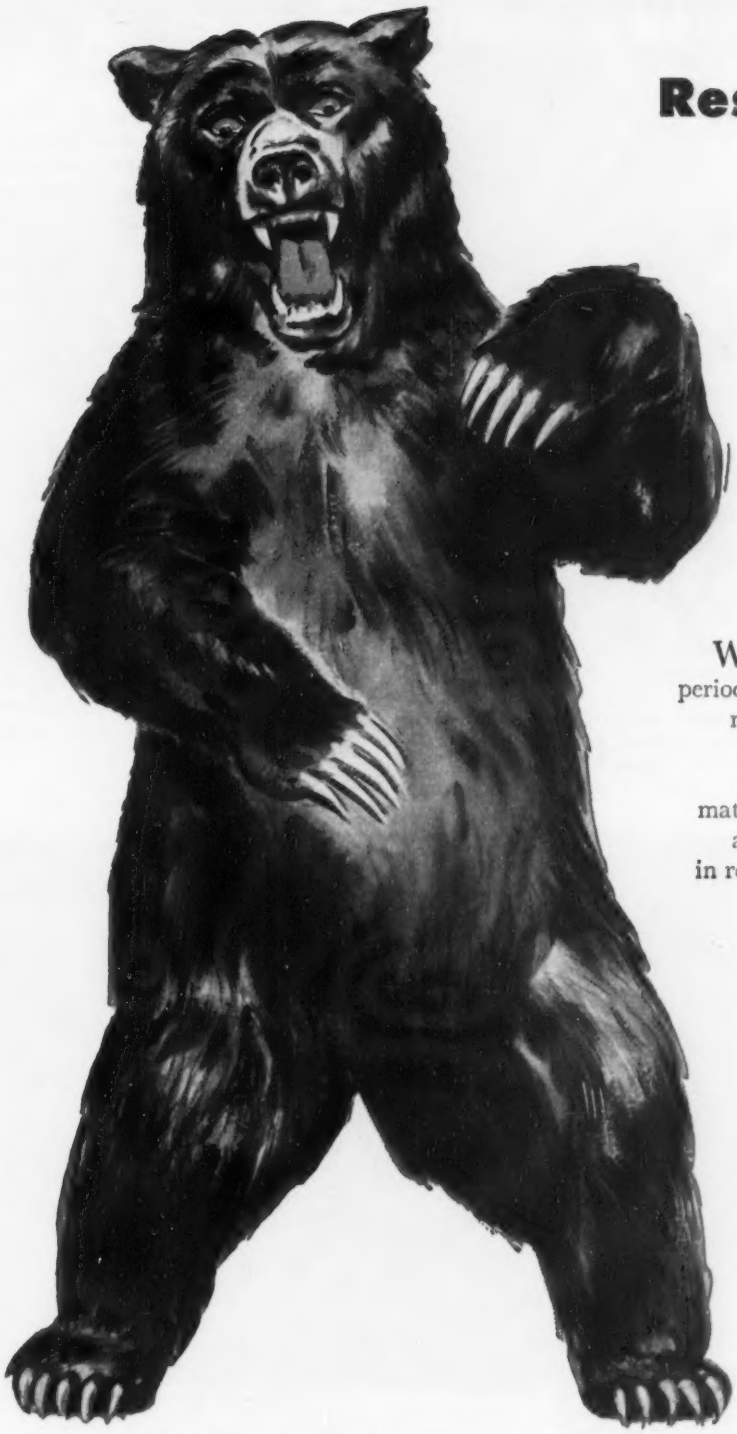
W. A. VEIT, Power Consultant, Southern California Edison Co, Huntington Park, Calif.

Installation of an infrared oven to speed drying time has increased the output of washed cars by 45% during the weekend rush period. In addition, the oven has cut labor costs by eliminating the need for two employees at the Arena Car Wash, South Gate, Calif.

Located at the end of the washing line, the oven evaporates most of the water remaining on the car after it has passed the air blowers. The oven is equipped with 216 infrared lamps totaling 81 kw. It operates automatically for a 60-sec period as each car enters the oven.

Before the oven was installed, four men were required to complete the drying operation. This limited the number of cars that could be turned out to about 275 daily. Now output has been raised to a maximum exceeding 400 cars per day and only two finish dryers are needed. According to Frank L. Pasquale, the owner, this marked increase in production and decrease in labor costs far offsets the 2.9 cents per car estimated operating expense of the oven.

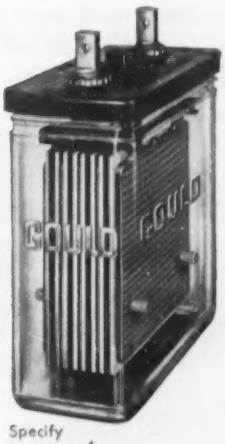
The market for similar installations has been broadened by the trend toward large auto laundries. Many small service stations no longer find such work profitable because of the high cost of labor.



Plenty of Reserve Strength

THANKS TO BATTERY POWER!

When emergencies demand prolonged periods of continuous performance, there's nothing like Gould Planté! The PURE LEAD POSITIVE PLATES in these batteries constantly renew the active material. They are always ready, always at full capacity, with plenty of power in reserve. Gould Plantés last practically forever—are the lowest cost standby batteries you can buy!



Specify
GOULD PLANTÉ—
The Aristocrat of Stationary Batteries

GOULD INDUSTRIAL BATTERIES

GOULD-NATIONAL BATTERIES, INC., TRENTON 7, N. J.

Always Use Gould-National Automobile and Truck Batteries

©1954 Gould-National Batteries, Inc.

The Old Reliable

EVERSTICK ANCHORS...

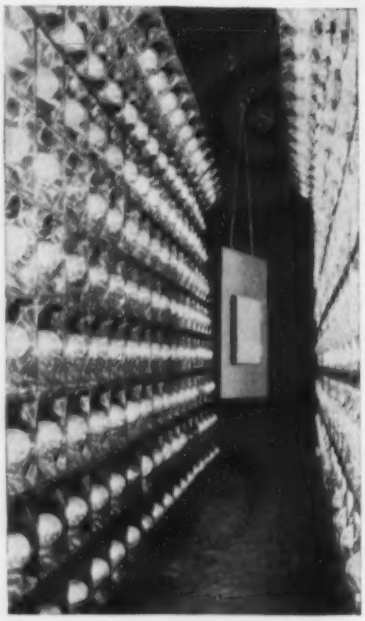
EXTRA Holding Power
QUICKLY Installed
TOUGH For long life

● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all others. Available two-way, three-way, four-way, and cone types. Write for facts.

Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.
Manufacturer of "THE ANCHOR OF MERIT"
FAIRFIELD, IOWA

Infrared Oven Speeds Paint Drying



PAINTED PANELBOARD COVERS are dried in 4½ min in this conveyorized 80-kw infrared oven. Production is 75 panels per day, compared to 40 with former air-drying method. Quality is improved

A. A. BISS, Industrial Power Engineer, West Penn Power Co, Pittsburgh, Pa.

Drying paint on control panel doors and cover surfaces at Penn Electrical Co, Irwin, Pa., is speeded and quality is improved with infrared oven and conveyor system. Production is increased 40% and labor is decreased 30%. The better-looking, more durable finish on panel faces has increased their acceptability to customers.

Previously, panel finishes were air-dried. This system was slow and space available for drying was limited.

Oven has 80 kw in infrared lamps. Conveyor system is motor-driven with chain drive and has variable speed. After degreasing, control panel faces receive a primer-surfacer finish. From paint spray booth, panels enter infrared tunnel oven and are brought to 400 F in quick-heat section. After passing this section, enamel is baked at 300 F. Total drying time is 4½ min. Oven has four banks which can be used individually or in combination. Panels 96 by 60 in. can be accommodated.

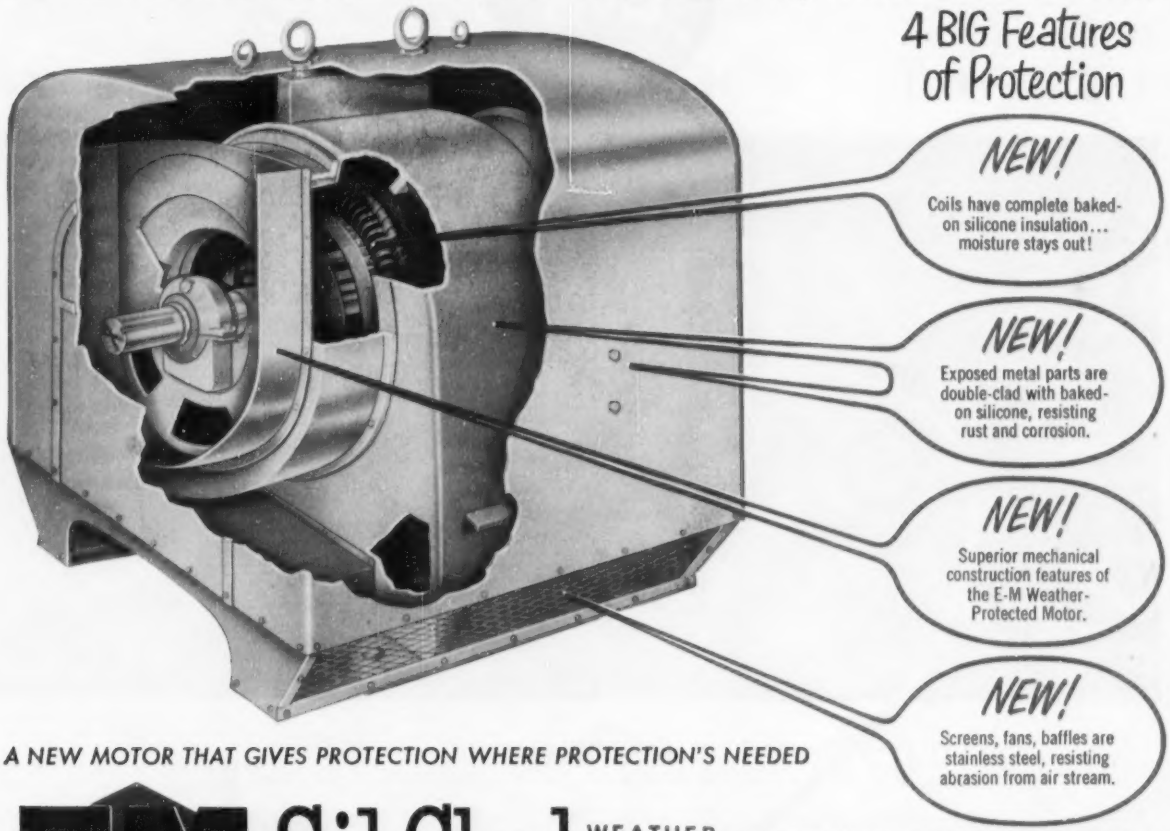
Continental Radiant Glass Heating Corp

Electric Radiant Heat Eases Drafts

Space heating in uninsulated guard headquarters building at main gate of The New Britain Machine Co, New Britain, Conn., with 10 radiant glass heating panels has eliminated workers' objections to drafts and provided better working conditions. Higher cost of operation, due to temporary nature of building construction, is offset by low installation and maintenance costs, according to R. A. Frost, Plant Engineer. **(Industrial Briefs on page 162)**

New E-M Silicone-Protected Motor

REPELS WATER AND RESISTS CORROSION, INSIDE AND OUT


4 BIG Features of Protection
NEW!
Coils have complete baked-on silicone insulation... moisture stays out!
NEW!
Exposed metal parts are double-clad with baked-on silicone, resisting rust and corrosion.
NEW!
Superior mechanical construction features of the E-M Weather-Protected Motor.
NEW!
Screens, fans, baffles are stainless steel, resisting abrasion from air stream.

A NEW MOTOR THAT GIVES PROTECTION WHERE PROTECTION'S NEEDED

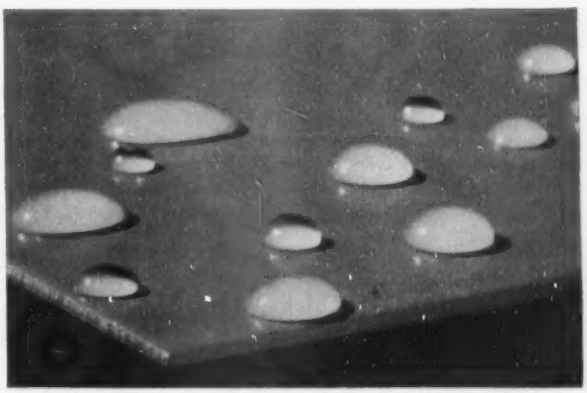
E-M Sil-Clad WEATHER-PROTECTED INDUCTION MOTOR

(250 hp and larger)

● Here's important news for engineers who would like to specify outdoor motors to minimize building costs at power stations, chemical plants, refineries, pipe lines, pulp and paper mills, smelters, seacoast industries, etc., but who have hesitated to do so because of adverse atmospheric conditions.

The important news is the E-M *Sil-Clad* Motor. It repels moisture penetration in wet, humid or steamy atmospheres. It resists corrosion from chemical fumes or salt air atmospheres. It resists oxidation from sun. In short, the complete silicone protection you get in *Sil-Clad* makes it possible for you to plan outdoor drives at a lower cost under conditions heretofore believed practicable only with the more expensive and not wholly protective totally-enclosed fan-cooled motors.

Get acquainted with the new *Sil-Clad* Motor now. In many cases it can substitute for outdoor totally-enclosed motors. *And Sil-Clad protection is offered on other E-M Motors too!* Ask your nearest E-M sales engineer for the complete *Sil-Clad* story . . . and write the factory for new Bulletin No. 217 which tells how the "wonder" properties of silicone are applied to full advantage in the great new *Sil-Clad* Motor.



SILICONE METAL PROTECTION REPELS WATER. See how the droplets of water pull away from the baked-on silicone coating. Coils and winding are silicone-protected, too, in the E-M *Sil-Clad* Motor.

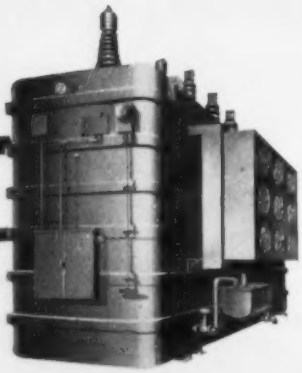
ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

1300-TPA-2178

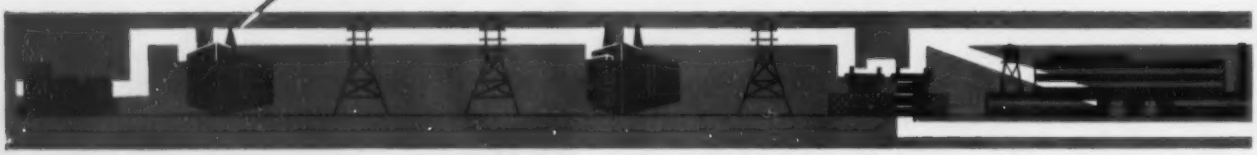
Specialists in making motors do EXACTLY WHAT YOU WANT THEM TO!

MOLONEY ELECTRIC

MOLONEY...



Moloney Power Transformers, engineered and built to your specifications, are available in any Kva and voltage rating for utility and industrial applications.

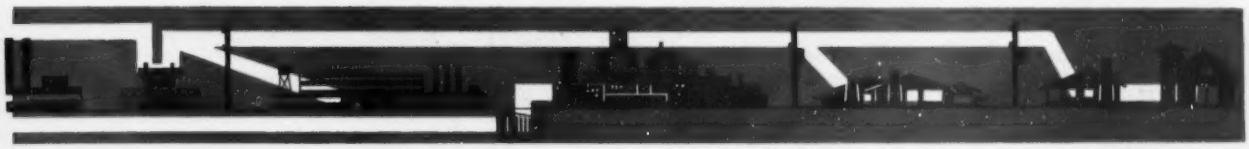


SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES

For years the name Moloney on a transformer has meant a better product. As utilities have grown and become more complex, so have transformers. All this expansion in the power field has been paralleled by expansion here at Moloney. Many utilities feel that Moloney Transformers are the best you can buy. They are right, because—

. . ALL ALONG THE LINE!

Take, for instance, Power Transformers; Today utilities demand transformers in higher Kva and voltage ratings. Yet, while Kva and voltage ratings are greater, and still growing, certain factors such as size are still limited. To keep pace with utility demands, Moloney expanded its facilities and developed new and improved designs to fit today's *and* future needs. Transportation limitations have influenced transformer design. To overcome these limitations, Moloney Engineers adopted shielded concentric layer type high voltage coils. Concentric layer high voltage windings possess both high mechanical strength and high impulse strength. With this type winding it is now possible to produce transformers of today's or tomorrow's ratings, within space limitations of present transportation systems. MES4-14



MOLONEY ELECTRIC COMPANY

Power Transformers • Distribution Transformers • Step Voltage Regulators • Regulating Transformers • Load Ratio Control Transformers • Unit Substations • Network Transformers • Constant Current Transformers • Capacitors • Transformers For Electronics

AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

DRAFT FANS

GO

on GREEN

Packaged Boilers Deserve Good Fans, Too!

The same engineering talents and the same careful construction go into the many stack supporting draft fans we have designed for the so-called "packaged" boilers. In some ways, engineering faces more difficult design problems because of the utmost efficiency required in a relatively small space.

Green Stack Supporting Draft Fans are practical, too. They are readily accessible for inspection and maintenance. Shafts and wheels are removable endwise without disturbing the stack or other structural members.

To those manufacturing "packaged boilers" or to those operating them with fans that don't seem to be doing the proper kind of a job or where maintenance seems too high, we offer the services of our experienced fan engineers to (1) design fans suitable for the boiler or (2) study the problem and recommend the remedy.

Our New Bulletin 168 gives details of our Stack Supporting Draft Fans. Write for a copy.

THE GREEN Fuel Economizer COMPANY INC.

BEACON 3, NEW YORK

ECONOMIZERS • FANS • AIR HEATERS • CINDERTRAPS

INDUSTRIAL BRIEFS

Heating liquids for impregnating rocket launching tubes, with electric immersion heaters at Cincinnati Industrial Finishing Co, permits accurate temperature control within close limits to produce product of uniform quality. Liquid in three large tanks is heated with banks of immersion heaters. Largest tank has 200 kw of immersion heaters. Other two tanks have total of 108 kw each. Load is fed by 240-v, 3-phase power supply. In starting process, it is first necessary to bring liquid up to temperature. This requires considerable time during which immersion heaters are continually energized. In order to keep 15-min interval kw-demand to a minimum, tanks are brought up to temperature, one at a time. After desired temperature is reached, only a portion of immersion heaters are required to maintain temperature and they are switched on and off intermittently with thermostatically-controlled contactors. L. J. Langevin, Power Engineer, Cincinnati Gas & Electric Co.

Drying evergreens with ordinary 5-kw hay drying unit at New West Evergreen & Wreath Corp, Pond Creek, Pa., has eliminated waiting periods due to damp greens and increased production and profits. Hay drier does equally good job of drying evergreens and company is well pleased with results. Roland E. Edmunds, Industrial Sales Representative, Wilkes-Barre, Pa.

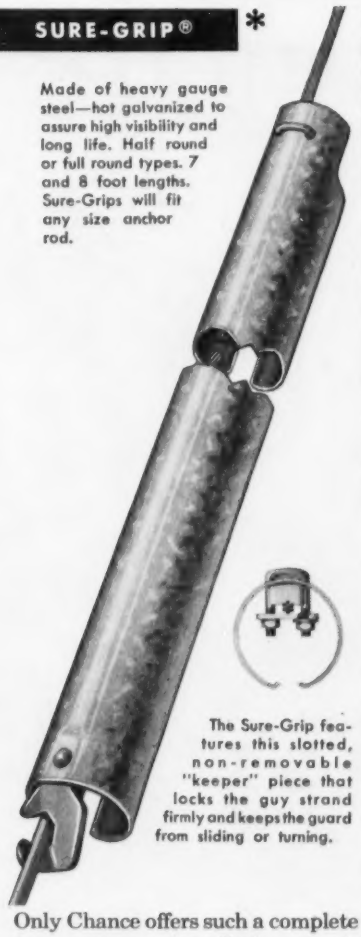
Paint drying on automobiles in the new "mobile bake shop" of Johnstan's Garage, Pittsfield, Mass., enables five cars to be completely refinished in one working day besides a number of fender jobs. Oven automatically rolls back and forth over car to bring heat from 18 kw of infrared lamps to the job. Paint job can be dried in 45 min. Western Massachusetts Electric Co.

Heating water with a 12.5-kw thermostatically-controlled immersion element inserted in a stoker fired boiler in wash house at Merrick Coal Co, Waynesburg, Ohio, assures hot water for showers and building heat in event of stoker failure. Electrical element takes over when boiler temperature drops 5 F below predetermined point. G. W. Craiglow, Industrial Power Engineer, Ohio Power Co, Canton.

Make Guys safe with
CHANCE GUY GUARDS...
a type for every installation

SURE-GRIP® *

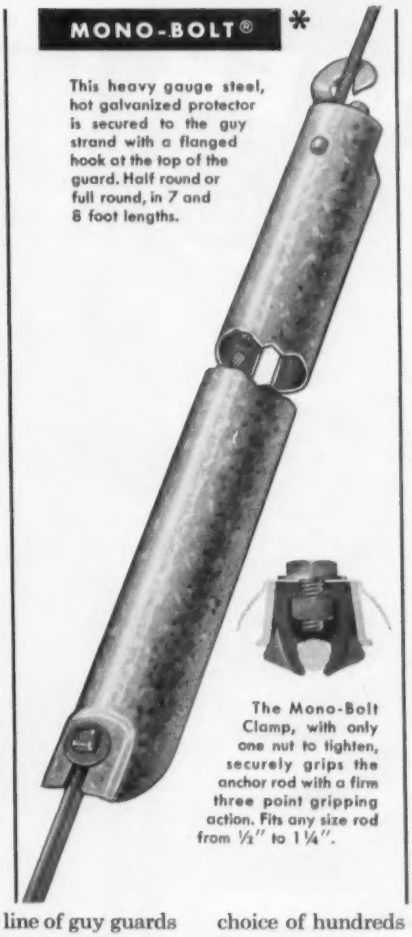
Made of heavy gauge steel—hot galvanized to assure high visibility and long life. Half round or full round types. 7 and 8 foot lengths. Sure-Grips will fit any size anchor rod.



The Sure-Grip features this slotted, non-removable "keeper" piece that locks the guy strand firmly and keeps the guard from sliding or turning.

MONO-BOLT® *

This heavy gauge steel, hot galvanized protector is secured to the guy strand with a flanged hook at the top of the guard. Half round or full round, in 7 and 8 foot lengths.



The Mono-Bolt Clamp, with only one nut to tighten, securely grips the anchor rod with a firm three point gripping action. Fits any size rod from ½" to 1¼".

MATTHEWS †

These half round guards save a lot of space on trucks and in storage, because they nest together. Matthews Guards are exceptionally strong—made of galvanized steel. Available in 7 and 8 foot lengths.

The patented upper clamping member is an integral part of the guard and securely locks on the guy wire. The lower end of the guard fastens to the guy clamp bolt.

Only Chance offers such a complete line of guy guards to meet your installation requirements. The line includes the service proved Sure-Grip, popular with linemen because there is nothing to take apart and re-assemble—no loose parts to lose. More than a million Sure-Grips are in use throughout the country . . . that's proof of the success of this protector.

Another favorite is the Chance Mono-Bolt, standard choice of hundreds of utilities. The Mono-Bolt combines normal guy wire protection requirements—safety, durability, and economy—with a simple installation method.

The Matthews Guy Guard cannot be turned or twisted on the guy wire. These one piece protectors are designed to cover the guy rod and wire to the ground line even if the rod barely extends above the ground.

* *Made by Specialty Devices Company, Subsidiary of A. B. Chance Co.*

† *A product of the A. B. Chance Company Matthews Plant.*

ABC INDUSTRIES

CG54-7

A·B·CHANCE CO·

CENTRALIA, MISSOURI · SAN FRANCISCO, CALIFORNIA

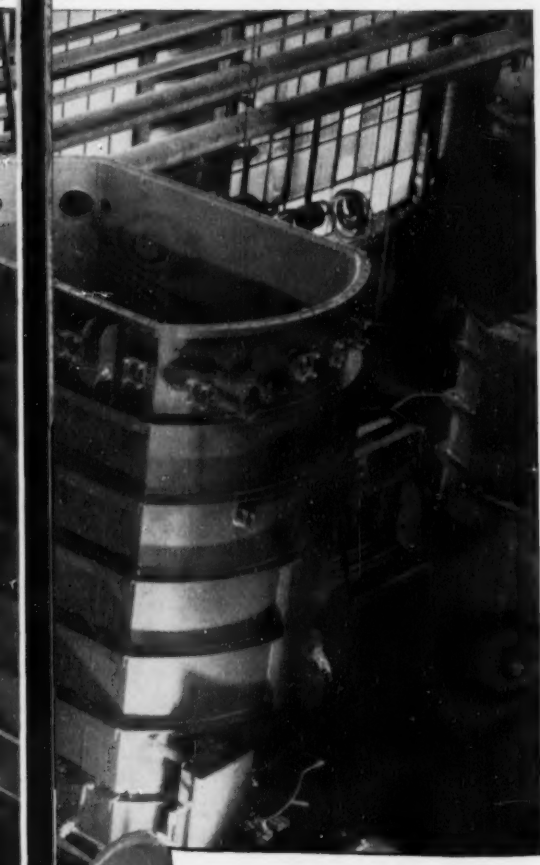
Maximum Per

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Milwaukee 1, Wisconsin

Return Dollar Invested



Corona-Free Transformers Stay Young Longer

Allis-Chalmers power transformers, thanks to their corona-free design, will produce profits on your system far longer than any transformer not thoroughly protected from the dangerous effects of corona.

How Insulation Design Helps Eliminate Corona

Insulation design reduces effect of concentrated dielectric fields. Danger from dielectric stress is reduced by placing insulation next to critical areas and by shaping insulation surfaces.

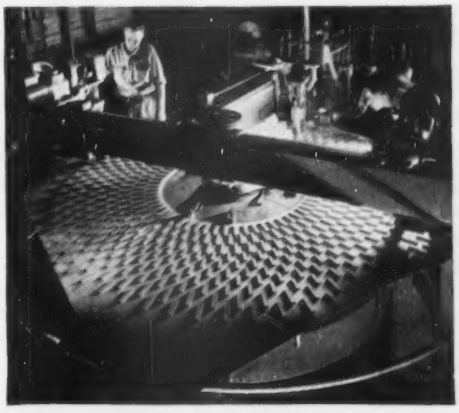
Proof of corona-free design comes when engineers use such tools as calculating boards, surge generators, and oscillographs to test for corona. These tests tell why it pays to install corona-free power transformers.

A-4016

Case Study in Improved Production Procedures

You get greater cooling efficiency from Allis-Chalmers power transformers thanks to the unique machine shown here. It fastens tens of thousands of spacers to the fuller board washers used in insulating transformers. The machine works quickly and precisely. There is no possibility that any of the thousands of spacers will be misplaced or improperly attached. This is quite a contrast with the days of painstaking manual labor the job used to require.

Within a few minutes one of the huge fuller board washers is placed in position and indexed. The machine then fastens each spacer separately and presses it into position. This machine is a good example of new machinery constantly being developed and manufactured in Allis-Chalmers extensive tool works. It's an important reason why you get the best workmanship and results when you specify Allis-Chalmers transformers.



PIZZA PIES bake quickly in a modern electric oven

STEAKS for a banquet are no problem with an electric grill

Duquesne Light Profits from Commercial Cooking Drive

ALEX R. HAMPSEY, JR,
Duquesne Light Co, Pittsburgh, Pa

Estimated annual revenue of $73,266.00 from 554 commercial electric cooking sales is the result obtained by the Duquesne Light Co in a three months special activity last year. The added load of 3,489 kw was 158.5% of the quota set.

To accomplish this result sales representatives made 4,473 sales calls on food service customers. In addition 153 demonstrations of electric cooking equipment were made and 2,543 rifle-shot direct mail pieces were requested by the sales personnel.

Thirty thousand (30,083) kilowatts of commercial electric cooking equipment have been added on our system since 1940. This represents an annual revenue of $605,146.00.

With the aid of a "Customer Record System" each territory was thoroughly analyzed and both effort and kilowatt result quotas were assigned to individual sales personnel. The effort quotas were based on cooking calls, total calls, mailings requested and demonstrations made.

Sales representatives concentrated sales contacts on food service accounts during the three months of this activity. A total of 4,473 cooking sales calls were made—62.5% of total sales calls made during the activity.

During the activity a total of 153 demonstrations were made. These included actual demonstrations of equipment and also visitations by customers to other electric cooking installations. We have found that these visitations to present users of electric cooking are very valuable in closing sales.

Direct mail and sales personnel stressed the importance of "Planned Electric Kitchens." Eight all-electric layouts were prepared by this department. This figure does not include layouts made by dealers.

Once again a hard-hitting continuous series of direct mail pieces was released on a regular schedule during the three month period. Nine mailings were sent to our Food Service list of 6,000 with a grand total of 54,000 pieces.

A highlight of the activity was an incentive plan for dealer sales people. Equipment sales reported by dealers were credited with one point for each kilowatt of equipment sold. Each point had a monetary value dependent upon the total points scored by all participants as against the amount allotted for the awards which was $1,000. However, no more than $1.00 per kw was to be paid. In addition small monthly prizes were given to stimulate reporting of sales made.

A total of 859.48 kilowatts of equipment was reported by dealers. Thus a total of $949.48 in prize awards was won by dealers with the highest figure given an individual of $255.80.

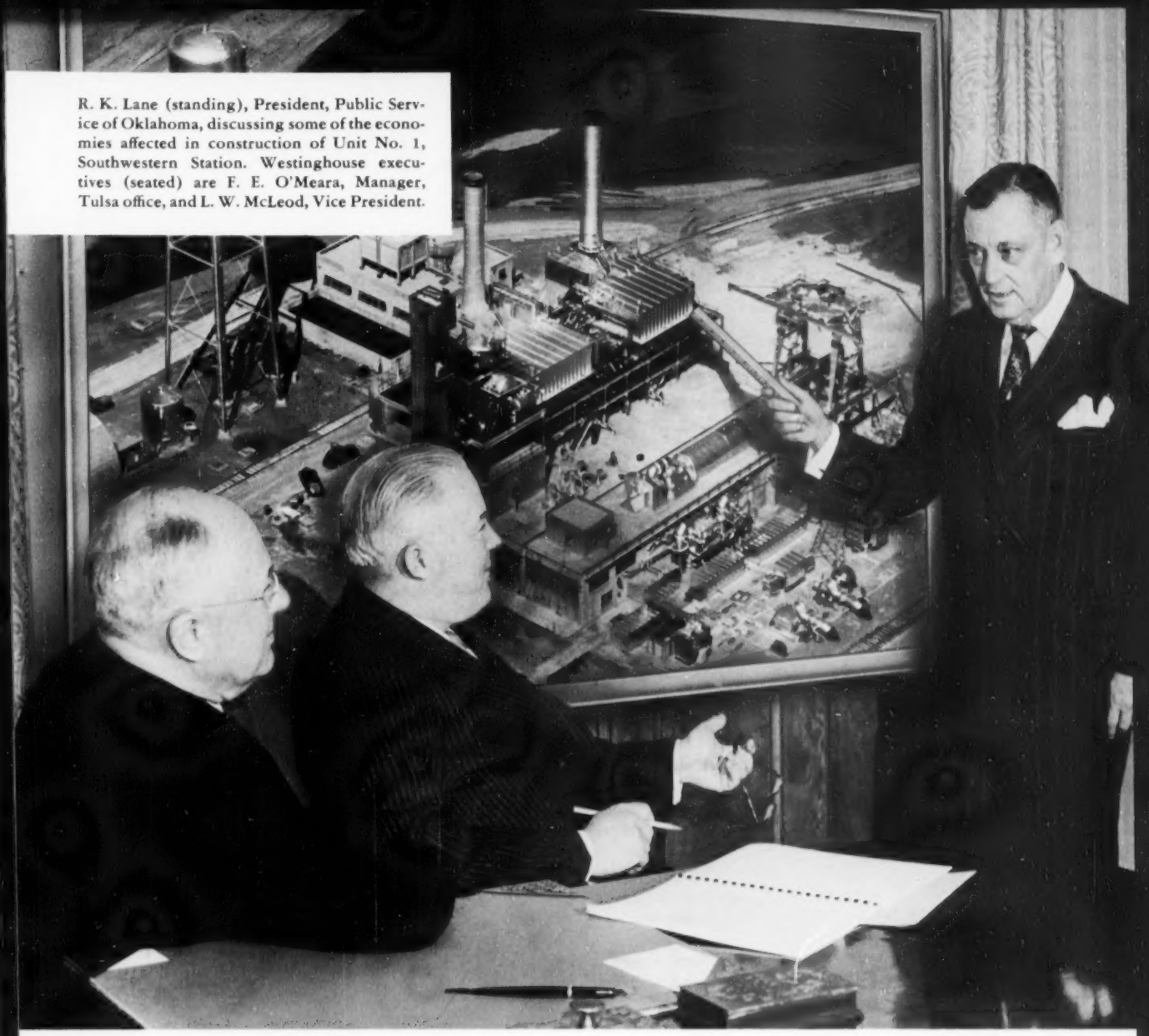
Changed Line Extension Policy Builds Load

A new line extension policy is paying dividends to Portland General Electric Co in the form of more reliable service to rural customers and less repair work for line crews. The new policy also has encouraged load building and has considerable public relations value.

PGE's new policy provides for company construction of new lines across customer property or replacement of obsolete poles and lines now owned by customers. Previous company policy required customers to erect their own poles and lines across their property to within 150 ft of PGE primary distribution circuits.

The distance across private property which the company will build depends upon the number of residential customers to be served and the number of major appliances in use. For a lighting customer without an

(*Continued on page* 183)



R. K. Lane (standing), President, Public Service of Oklahoma, discussing some of the economies affected in construction of Unit No. 1, Southwestern Station. Westinghouse executives (seated) are F. E. O'Meara, Manager, Tulsa office, and L. W. McLeod, Vice President.

From cotton field to power plant . . . in 369 days

Public Service of Oklahoma's amazing feat of transforming a cotton field located over a solid base of sandstone—with no access roads available—no power in the vicinity—to Unit No. 1 of Southwestern Station is a story worth telling.

Public Service started the story when they decided to meet their growing load with additional capacity in their southwestern region. The site on the Washita River, 150 miles southwest of Tulsa, Oklahoma, was selected because it had a water supply not generally available in this region. It was at the load center and the geographic center of this growing region and near the center of the Anadarko Basin oil and gas fields with a ready supply of reasonably priced fuel.

Early in the planning stages, the utility with their

(*continued next page*)

YOU CAN BE SURE . . . IF IT'S

Westinghouse

(continued from preceding page)

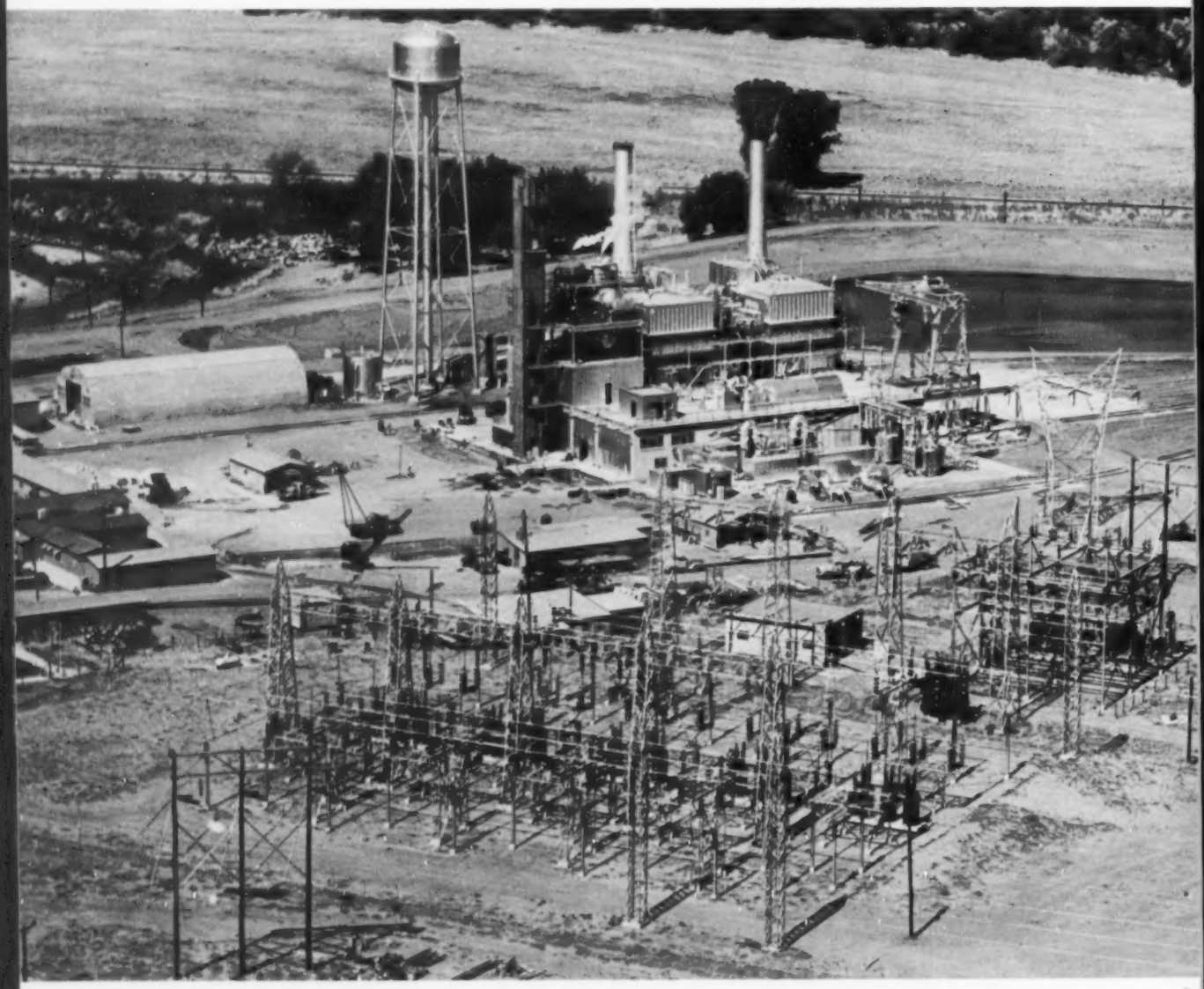
consultants (Sargent and Lundy) determined that Southwestern Station would be an outdoor station and that the prime supplier of equipment would be Westinghouse. Choosing Westinghouse as the single supplier for all major components permitted side-by-side planning and the extra advantage of on-the-spot refinements and economies in equipment and selection.

Public Service then constructed ¾ of a mile of new railroad track, rebuilt bridges and cut 3½ miles of road to the plant site.

539 construction workers were employed in erecting Unit No. 1. Weekly meetings were held throughout the construction period with foremen and construction workers to discuss progress and plan work schedules for the coming week. All personnel were thus kept fully acquainted with the over-all status of work . . . a foresight which expedited "on-the-line" date by 60 days.

• • •

Aerial view of the complete installation of Unit No. 1 at Southwestern Station of Public Service of Oklahoma showing the adjoining substation.



YOU CAN BE SURE...IF IT'S Westinghouse

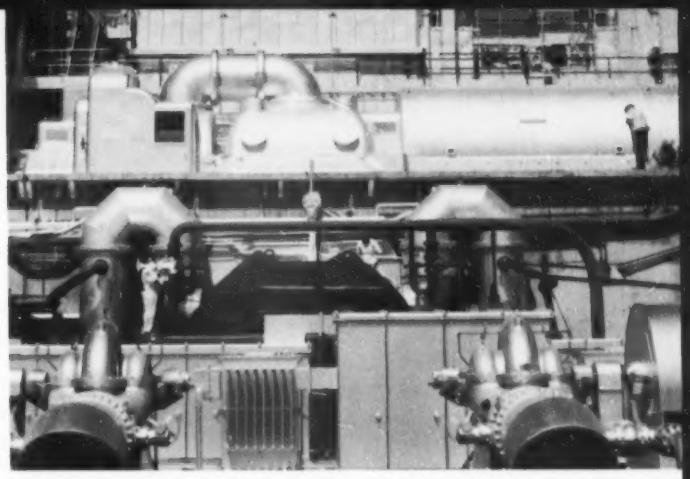
In spite of location "extras", installed cost was only $99.83 per kw output

The low installed cost of $99.83 per kw actually realized on this project as against costs of $125.00 and $135.00 per kw for a conventional power station was more remarkable in view of the many "extras" required because of location.

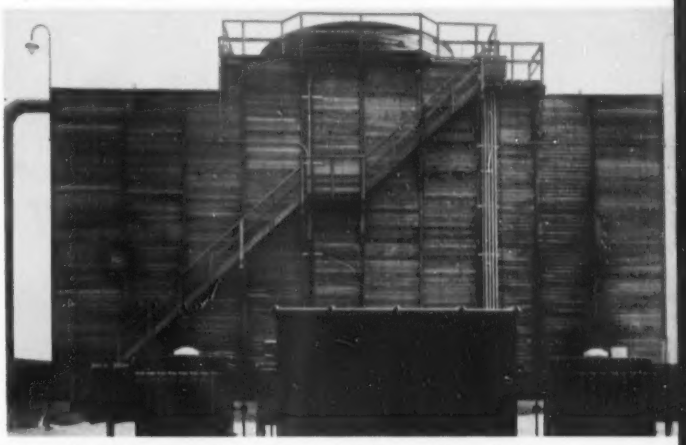
For example, a special water-treating plant was necessary due to the high mineral content of the water. The low rate of flow of the Washita River necessitated the erection of a special, eight-cell cooling tower and two water storage reservoirs holding 33 million gallons.

The cooling towers, particularly, placed unusual burdens on other station equipment. The fan on each cell required a reliable and high-torque electric motor drive, which was taken care of by using standard Westinghouse Life-Line® motors. The towers also imposed a higher pressure head on the condenser. Westinghouse met this unique problem by applying their extensive heat exchange experience to design a condenser which kept moments (forces) on the turbine exhaust within normal values, for more efficient and dependable operation.

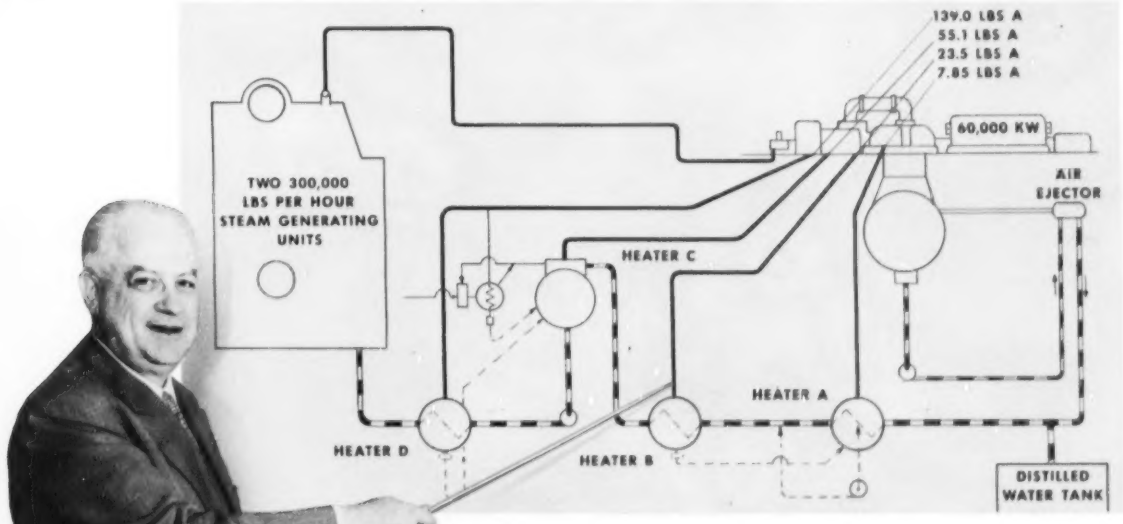
In spite of these location, design and construction problems, Public Service of Oklahoma made a remarkable record in getting "on the line" and attaining heretofore unavailable economies in new station construction.



Single source for turbine and condenser enabled Westinghouse to design for low headroom and improve performance by engineering the two as a "package" for all steam and water conditions.

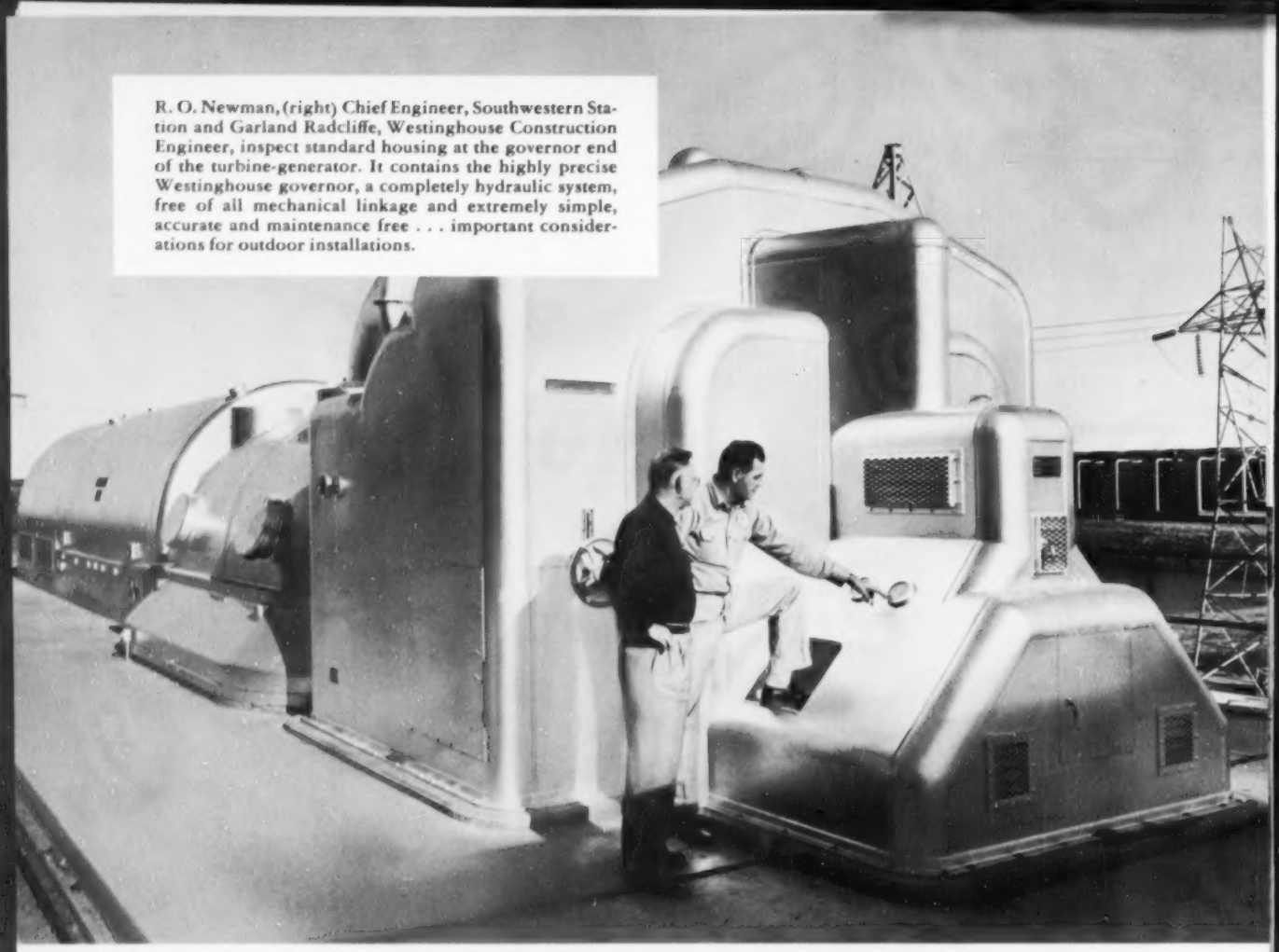


The mineral content of local water and low flow of the Washita River required a special water system. This included two 33 million gallon storage reservoirs and an eight-cell cooling tower, shown above.



Steam rate to turbine (lb /kwh)	8.28
Btu/kwh to turbine	9,382
Boiler efficiency	83.1
Btu/kwh sent out (100% Op. Efficiency)	11,822
Plant thermal efficiency	28.87

G. I. Page, Superintendent of Operation and Construction at Public Service points out a typical performance diagram for Unit No. 1.



R. O. Newman, (right) Chief Engineer, Southwestern Station and Garland Radcliffe, Westinghouse Construction Engineer, inspect standard housing at the governor end of the turbine-generator. It contains the highly precise Westinghouse governor, a completely hydraulic system, free of all mechanical linkage and extremely simple, accurate and maintenance free . . . important considerations for outdoor installations.

Design coordination of steam apparatus speeds planning, construction

One way Public Service attained low installed cost was by relying on their single supplier for recommendations and manufacturing coordination of all apparatus. This was specifically reflected in selection of the turbine-generator. Westinghouse experience in utility industry requirements indicated that Public Service's desire for maximum economy could best be met by specifying a 66,000-kw ASME-AIEE Preferred Standard Design. This choice not only cost the utility less for actual equipment, but reflected additional savings in speedier delivery.

Coordination proved valuable in other areas as well. In outdoor plants it is essential to keep headroom low and locate major components in a compact area—to realize savings in foundation and structural costs. In helping Public Service effect these cost reductions, Westinghouse designed their turbine-generator and condenser for low headroom installation, using conventional bottom-mounting, instead of a more costly side-mounting condenser.

The same problem of space economy led to the use of vertical-type feedwater heaters. The ruggedness and high efficiency demanded for outdoor installation and effective boiler feedwater heating are inherent in the design of the one high pressure and two low pressure units which were furnished. No extra construction, protection or design consideration was needed.

YOU CAN BE **SURE**...IF IT'S Westinghouse

Unique techniques expedite installation, lower costs

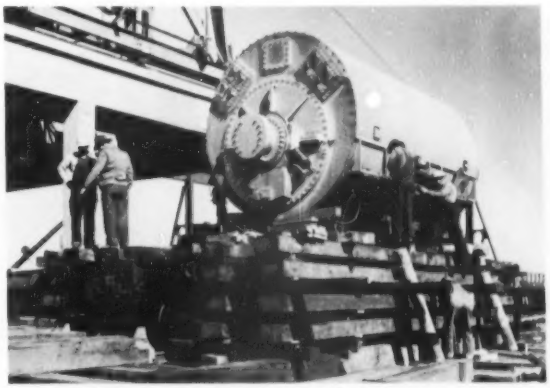
W. C. McGuire, Project Manager for Public Service, assisted by Westinghouse field engineers, used every possibility afforded by the outdoor construction and Westinghouse design simplicity and coordination to set the Southwestern Station "on-the-line" record.

Again the planning and supply of all apparatus from a single source was a major factor. The care and skill of Westinghouse turbine design and manufacture, especially, made installation of the turbine an easy job. The precise factory balancing of the rotor, the extensive factory testing before shipment, the coordinated design of turbine and generator streamlined the installation and resulted in perfectly smooth operation from the moment the turbine went on the line.

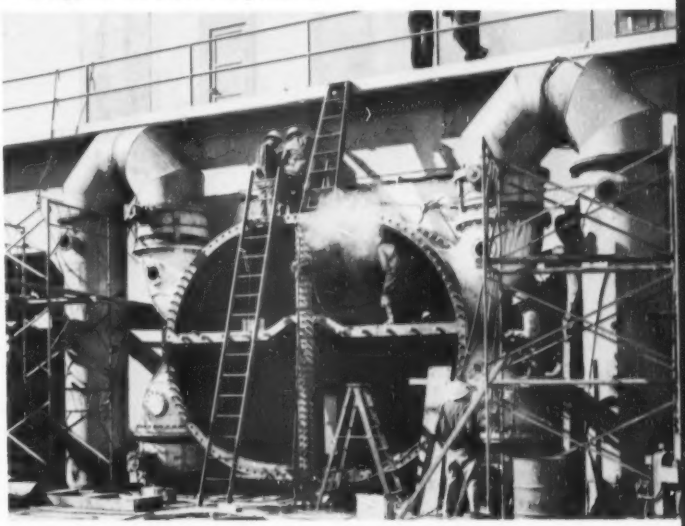
The completely self-contained generator with hydrogen cooler was moved into position alongside the foundation and thus easily slid into place. This saved many man-hours of work.

Westinghouse also designed the condenser for welded assembly right on the job—split along the horizontal. It was again, a simple matter to assemble outside the foundation and slide into place . . . ready for final connections. Similar procedures worked equally well with all the other heat exchange apparatus which was assembled on the ground and readily hoisted into place, resulting in a saving over more conventional methods.

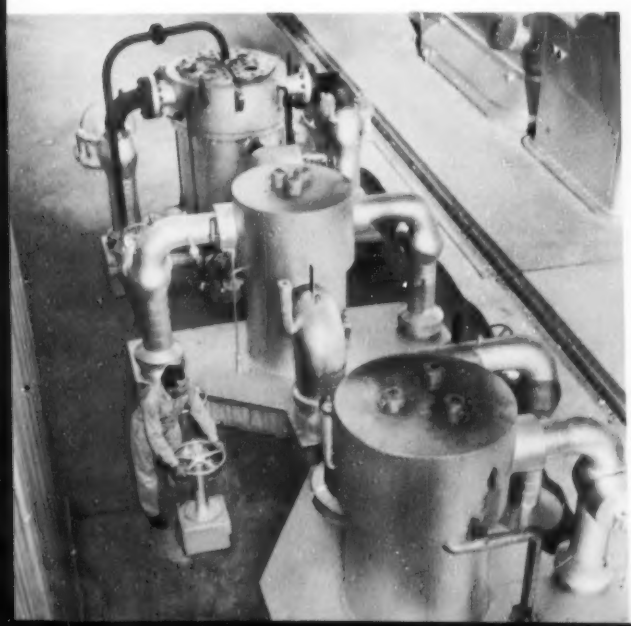
Expert design and precise manufacture of this turbine rotor help assure perfect mating of turbine and generator. It is a big reason why Westinghouse turbine-generators get on the line quickly and stay on.



Public Service of Oklahoma saved time and money by cribbing up the Westinghouse generator level with the top floor, then sliding it into position on the foundation. Outdoor construction of the station and rugged integral design of the generator made this possible.

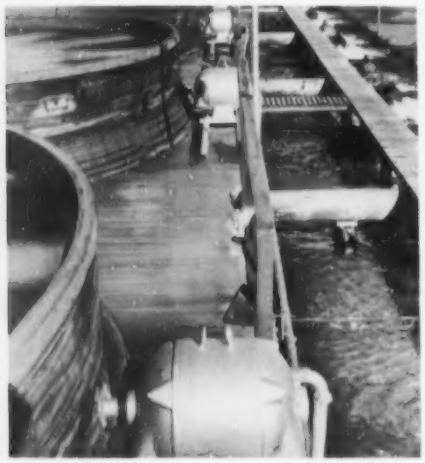


Shell of specially designed condenser in place. Top and bottom sections were completely assembled and welded outside the foundation—a cost-saving technique made available through Westinghouse experience.



◀ Chief Engineer R. O. Newman at feedwater heaters. The high pressure unit, to the rear, is equipped with exclusive quadrant head—specially designed to provide the strongest construction and greatest dependability.

Project Manager W. C. McGuire checks blueprints of the circulating water pumps which operate at 30,000 gpm. They are driven by Westinghouse 800-hp, 14-pole induction motors. Special weather-protected construction provides adequate outdoor protection here with minimum expense. Covers and air shields of these motors are easily removed for inspection. The split-bearing construction permits removal without disturbing the bracket mounting.



Each of the eight giant fans on this cooling tower is powered by a Westinghouse Life-Line motor. The tower's total capacity of 60,000 gpm is part of the service water and treated water systems, supplementing intake from the Washita River.

Condensate is pumped by this 60-hp, Life-Line CSP® motor to the deaerating tank and heater. A duplicate stand-by motor is provided. Vertical mounting of the motor integral with the pump shaft saved space and time here.

Compact control centers provide one-point control and protection of powerhouse auxiliaries. Standard vertical sections provide complete flexibility. Motor starters up to NEMA size 7 can be included.

YOU CAN BE **SURE**...IF IT'S

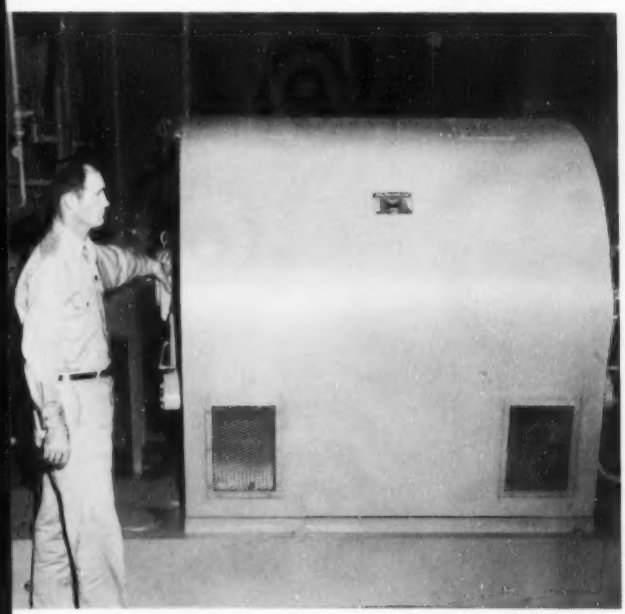
Special attention given powerhouse motors insures economy of electrified auxiliaries

By relying on Westinghouse powerhouse motors for all auxiliaries at the Southwestern Station, Public Service of Oklahoma gained many installation and operating economies. Westinghouse engineers special-ordered each motor for maximum attention to construction details and minimum delivery time. Once installed, each motor was quickly tied into the station auxiliary power system. The expense and time of constructing auxiliary steam lines and reducing stations were eliminated.

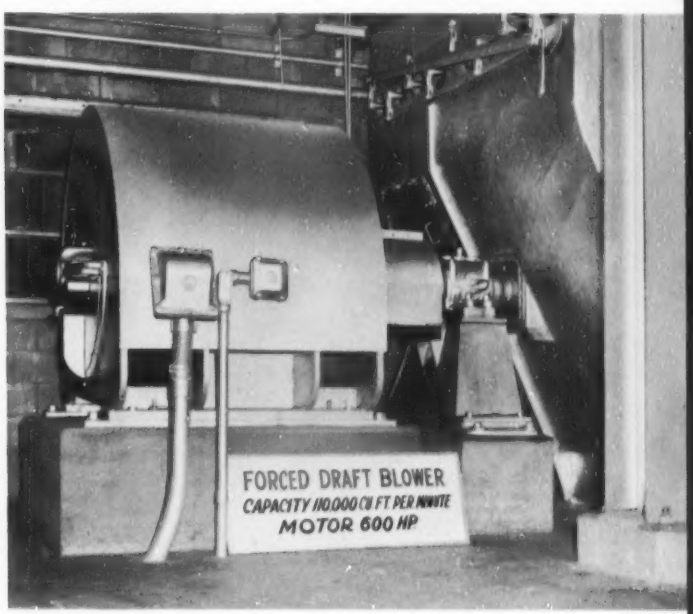
Operating economy resulted, too. Without auxiliary steam requirements, make-up feedwater demands were reduced . . . an important factor at Southwestern Station where extensive feedwater treatment is necessary. In addition, auxiliary motor control panels are centrally located to cut down on time required for operation.

Westinghouse engineers assured Public Service of Oklahoma of the continued economical operation of these powerhouse motors. Each installation received special attention: first, in analyzing load conditions and horsepower requirements; next, in construction, with all component parts being tested for highest quality workmanship. Finally, before shipment, each motor was given a complete operating test and inspection by the Westinghouse quality control department.

Westinghouse powerhouse motor insulation provides greatly improved dielectric and physical strength as well as superior moisture resistance. Two extra dip and bake insulation treatments are given all powerhouse motor windings as added protection against heat, dust and other adverse operating conditions.

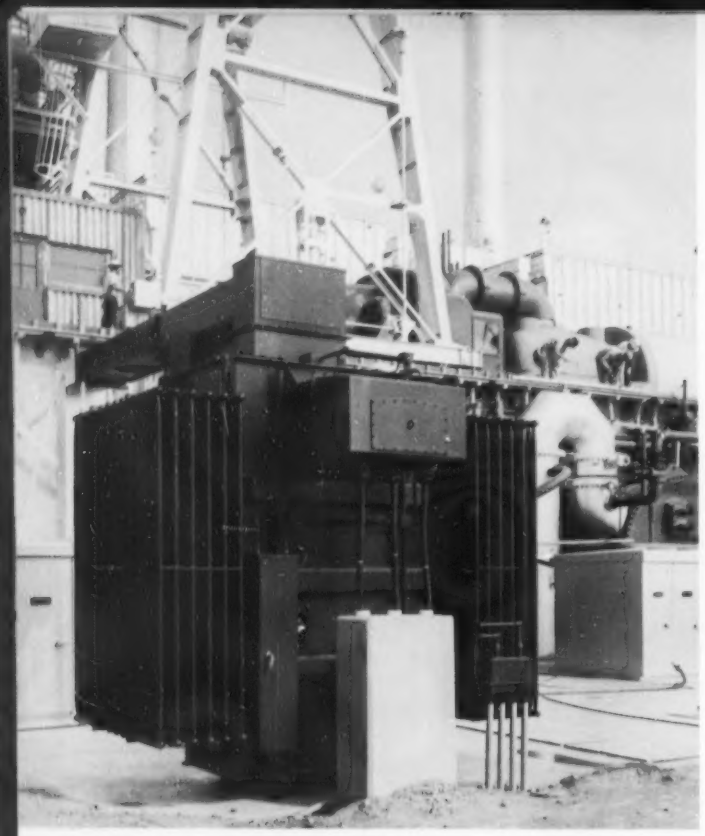


Two 1750-hp, 3600-rpm Type CSF motors supply power for boiler feed pumps in Unit No. 1. These motors are self-ventilated with louvers and internal baffling to direct air flow to best advantage.



Forced-draft blowers on both boilers in Unit No. 1 are powered by Westinghouse 8-pole, 600-hp weather-protected induction motors.

Westinghouse



Shown above, one of two identical Westinghouse 6000-kva, 13,800-volt auxiliary power transformers of core form design. Westinghouse core form transformers can be built using one of five types of windings to meet specific current and voltage requirements. These five types are: (1) Continuous pancake, (2) Hisercap, (3) Lowgrocap*, (4) Helitran, (5) Cylindrical.

*Trademark

Transformer design adaptable to fast, economical installation . . .

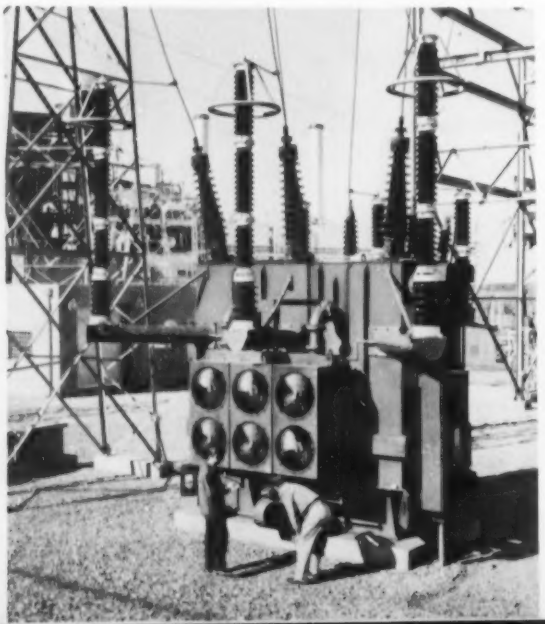
For instance, a 97-ton, 50,000-kva Westinghouse autotransformer was installed in 9 hours flat, resulting in an inexpensive installation.

The main power transformer at Southwestern rated at 88,500 kva, 138 kv, is of exclusive Westinghouse "Form-Fit" design, which enabled one-piece shipment direct to the site. Form-Fit construction using grain-oriented Hipersil® core steel with greater flux-carrying capacity permitted an approximate 20% reduction in weight, 15% smaller ground area. These factors coupled with lower over-all height made possible the use of lighter handling equipment and minimum steelwork.

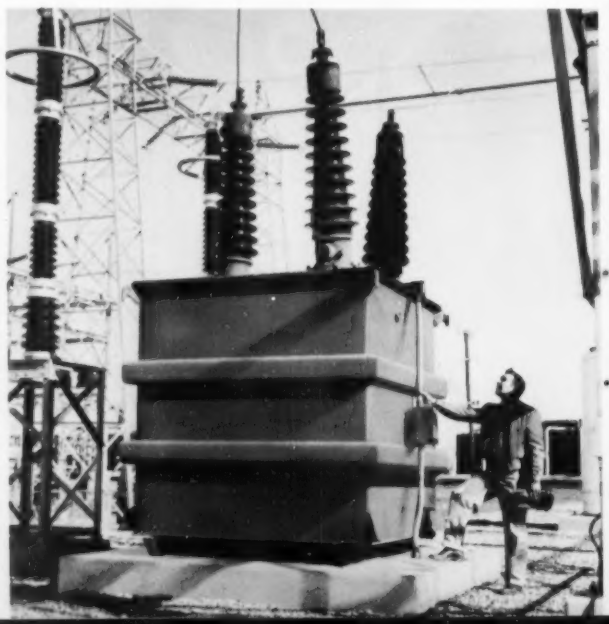
In addition, Southwestern uses economical Westinghouse standardized design transformers, of core form construction, wherever possible.

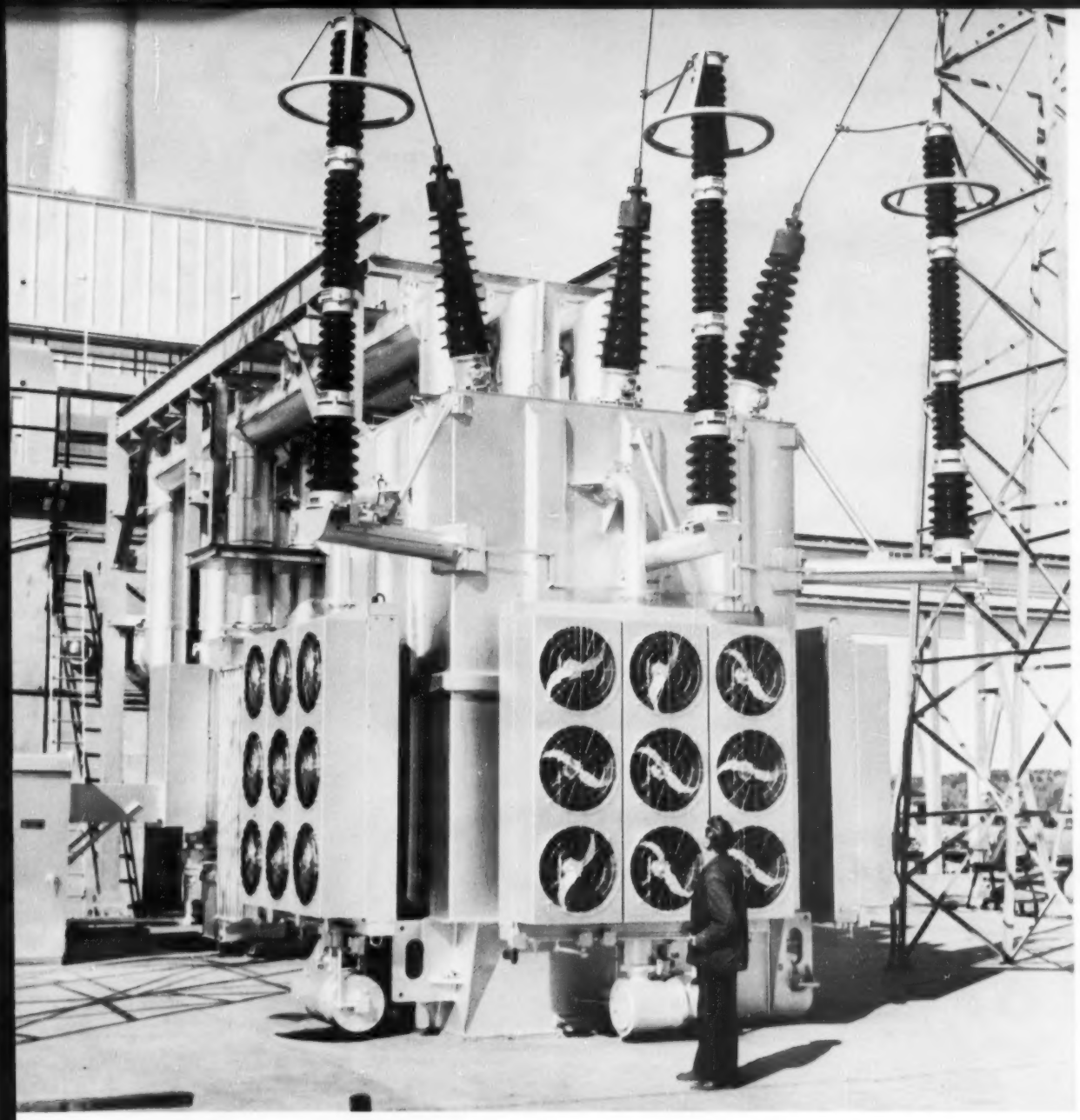
The utilization of both Westinghouse Form-Fit and core form power transformers gave Southwestern many advantages in efficiency and economy not obtainable with the application of just one design throughout. This selective factor contributed greatly to their excellent cost record.

D. R. Campbell, Station Engineer and R. W. Ingalls, checking out the 50,000-kva, 138-kv/69-kv power transformer used in the substation. It is smaller and lighter per kva because of its Form-Fit construction. The lightning arresters are Type SV outdoor arresters capable of discharging lightning surges of more than 100,000 amperes.

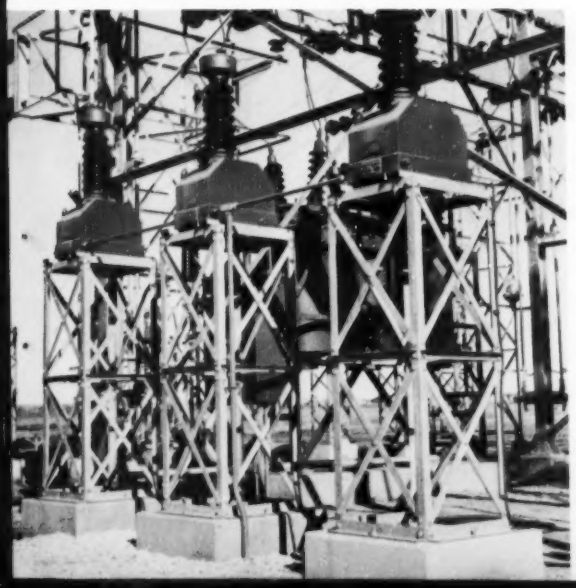


W. G. Steidley of Public Service examines the Westinghouse OA Grounding Transformer. The unit is rated 3,180 kva, three phase, 13,800 volts, 400 amperes ground current, 40 ohms per phase impedance. The hermetically-sealed Type S condenser bushings provide the highest possible dielectric and mechanical strength.





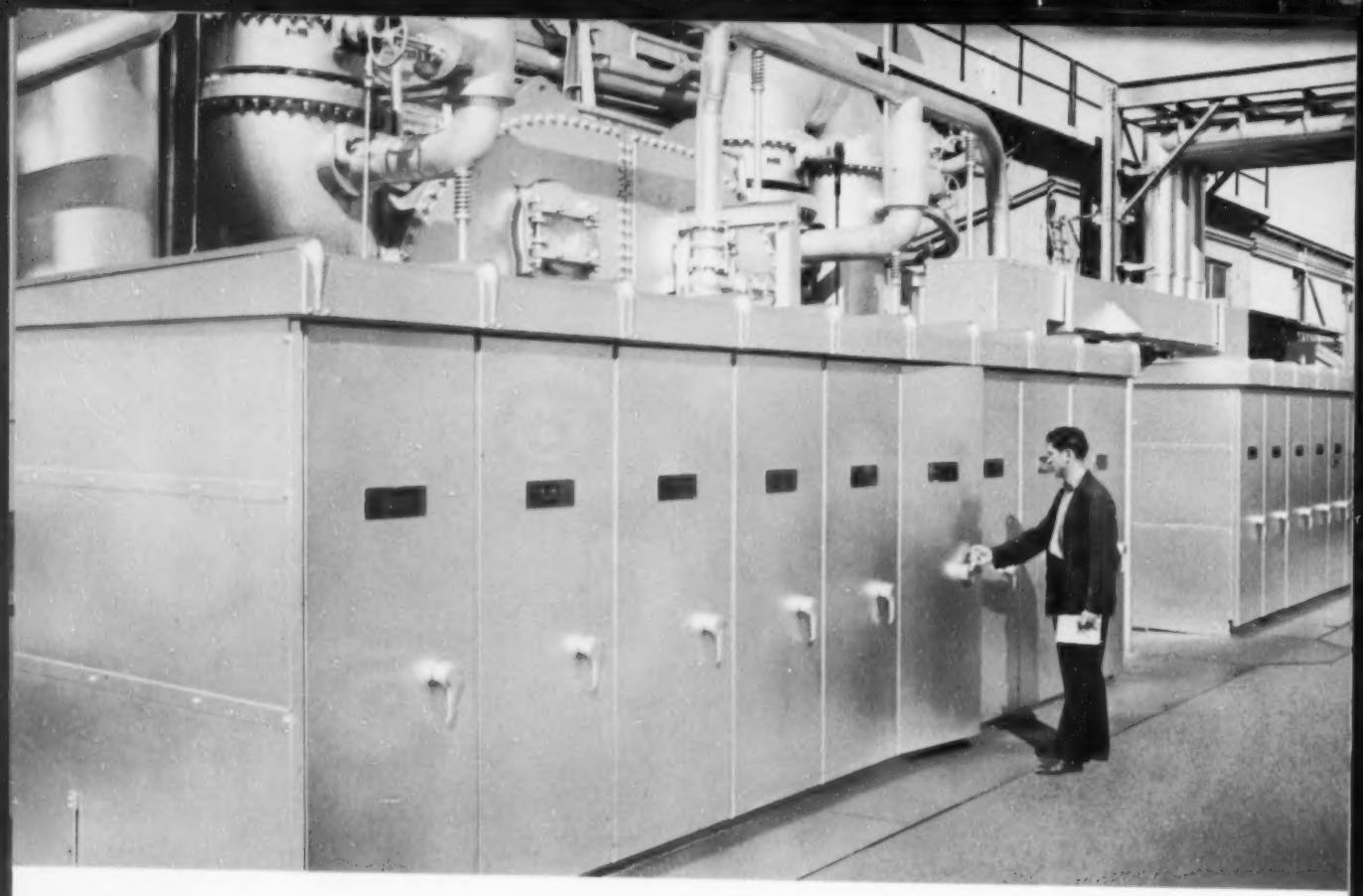
R. W. Ingalls, Assistant Chief Engineer of Southwestern Station inspects the 88,500-kva, 138-kv Westinghouse power transformer. The exclusive Form-Fit design of this FOA unit made possible smaller size and weight while still providing greater mechanical, thermal and dielectric capabilities.

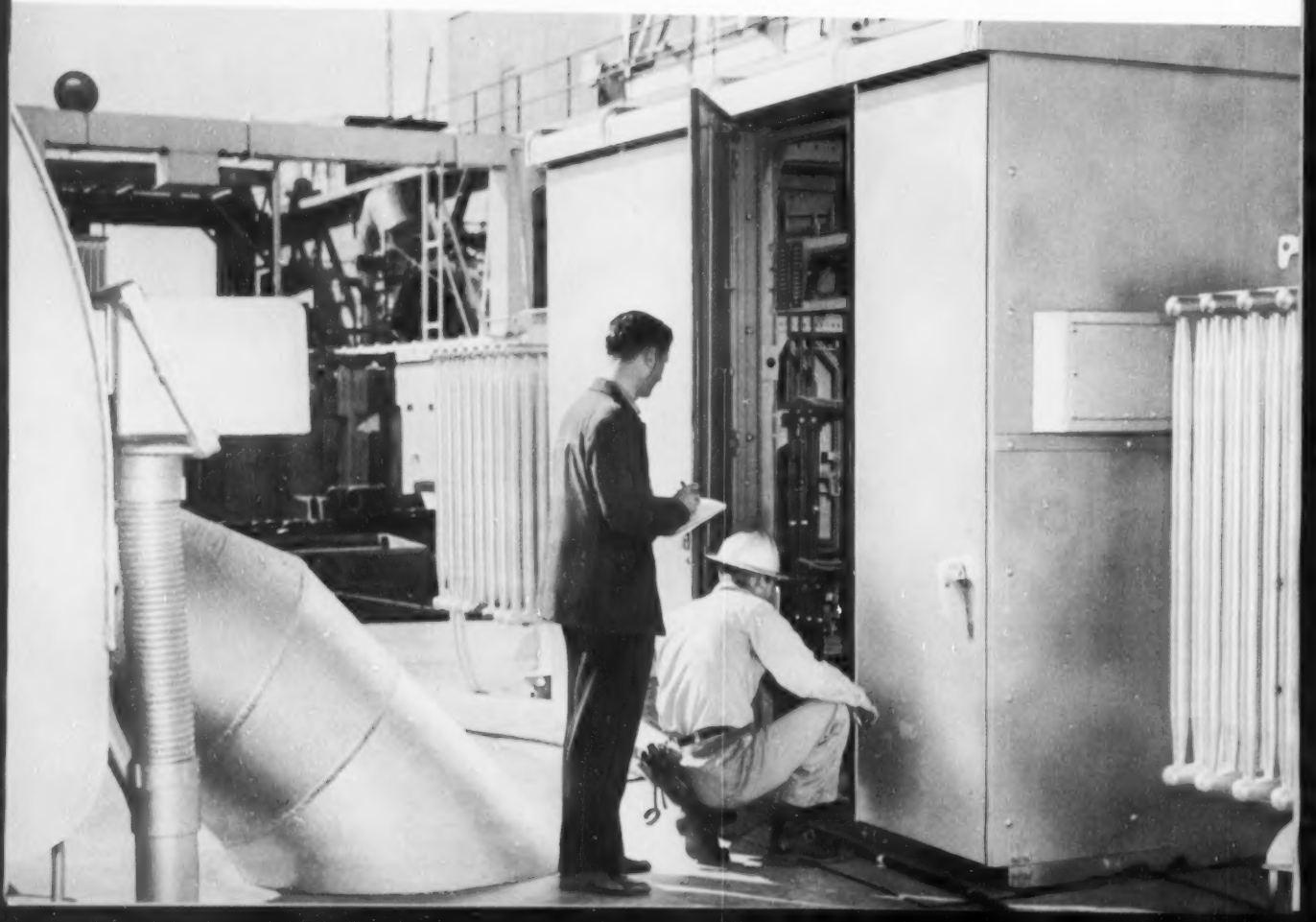


◀ This neat, metering installation features three Westinghouse Type OPT Potential Transformers. Rigid production-line quality control assures dependable long-term accuracy.

YOU CAN BE SURE...IF IT'S

Westinghouse





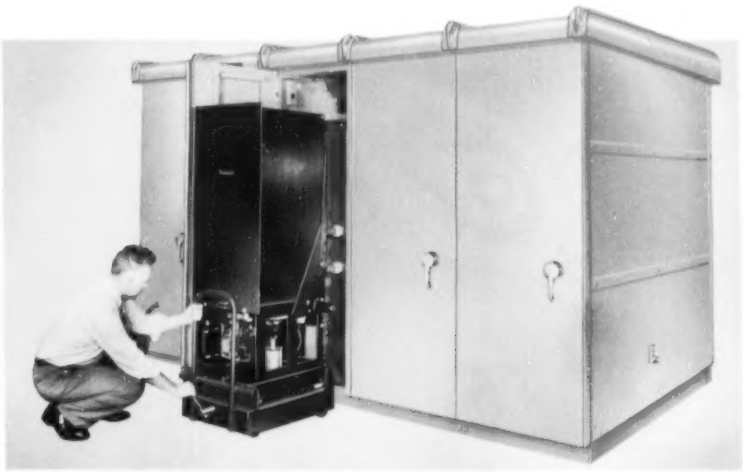
"Westinghouse outdoor metal-clad switchgear is easy to install"

W. C. McGuire, Public Service of Oklahoma's Project Manager, made this statement. He based it on outstanding features of this outdoor switchgear installation. Its compact, metal-enclosed design simplified unloading and foundation arrangements. The switchgear needed only to be mounted on the foundation, and then the main and control circuits were easily connected. The complete apparatus was factory assembled, factory wired and factory tested, eliminating all such requirements at installation point.

Standardized design throughout the switchgear contributes to lower cost of operation and maintenance. Metal-enclosed compartments provide safe, convenient accessibility to all component parts and permit more circuits in less space. Horizontal drawout breaker arrangement permits easy inspections or replacements. Maintenance of the switchgear is simpler because the time required in getting to and servicing the components is reduced to a minimum.

The integral unit design facilitates the addition of future circuits as they are required.

◀ R. W. Ingalls of Public Service is shown checking out this flexible, compact 2,300-volt Westinghouse unit substation. An outdoor installation of this type is under constant attack—inside and out. To combat internal arc damage, Westinghouse lines arc chutes with a true ceramic material containing zircon, which has the highest melting point of any known material.



De-ion® air circuit breakers used in Westinghouse switchgear draw out horizontally. No lifting or lowering is necessary. This reduces routine testing and maintenance time. Breakers of the same rating are interchangeable and can be replaced in a matter of minutes. All Westinghouse breakers take advantage of the De-ion principle of arc quenching which literally snuffs out the arc in as little as one cycle or less.

◀ The 440-volt power center, like its big brother, contains all of the basic construction details perfected by Westinghouse through years of practical application—under all conditions. To combat external weather, all metal parts are Bonderized for protection against rust and corrosion. Undersurfaces are sprayed with heavy rubberized coating.

YOU CAN BE SURE...IF IT'S

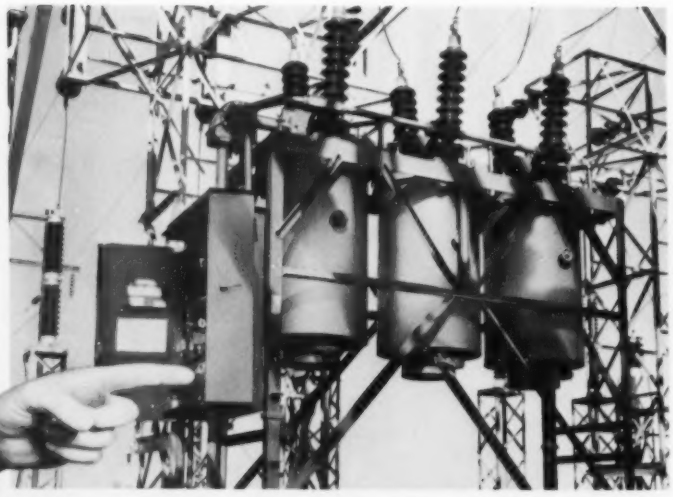
Westinghouse

Power breaker design simplifies maintenance— field adjustments

The selection of floor-mounted Westinghouse power circuit breakers for Public Service of Oklahoma's Southwestern Station was based on their over-all simplicity of design, ease of installation, ease of inspection and adjustment. Result: less maintenance.

Westinghouse De-ion grids, for example, use the multiflow principle of arc interruption which provides high-speed clearing of faults with very short arcing time and low arc energy. Result: less contact burning and oil deterioration.

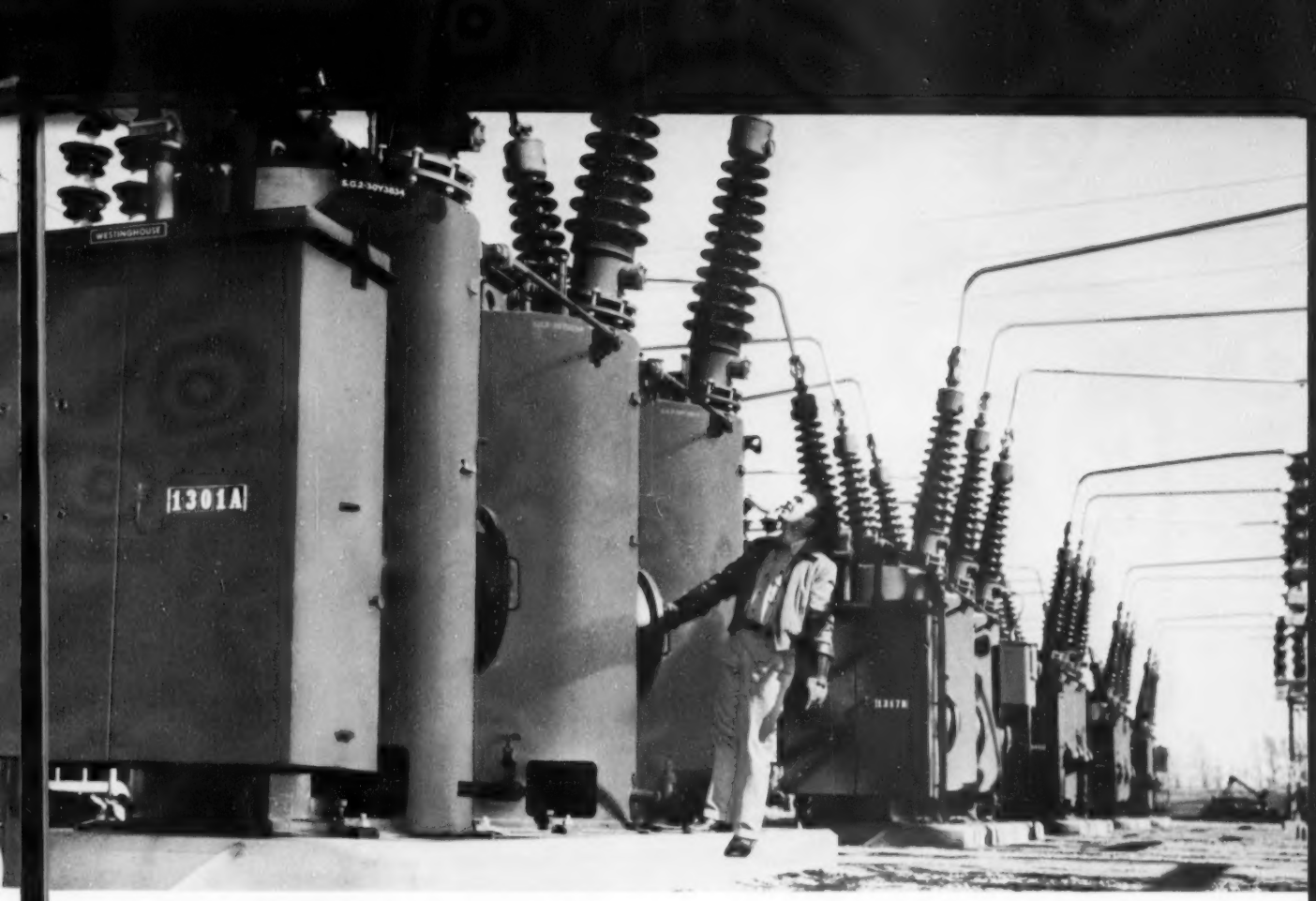
The condenser bushings used in Westinghouse power circuit breakers are designed on the sound electrical principle of uniform voltage distribution. Bushings through 69 kv are solder sealed and the higher voltage bushings are oil impregnated. Result: no radio interference, long insulation life.



Southwestern Station's Chief Engineer, R. O. Newman points out one of his Westinghouse 69-kv frame-mounted oil circuit breakers. These units were shipped completely assembled and adjusted, thus minimizing installation expense.

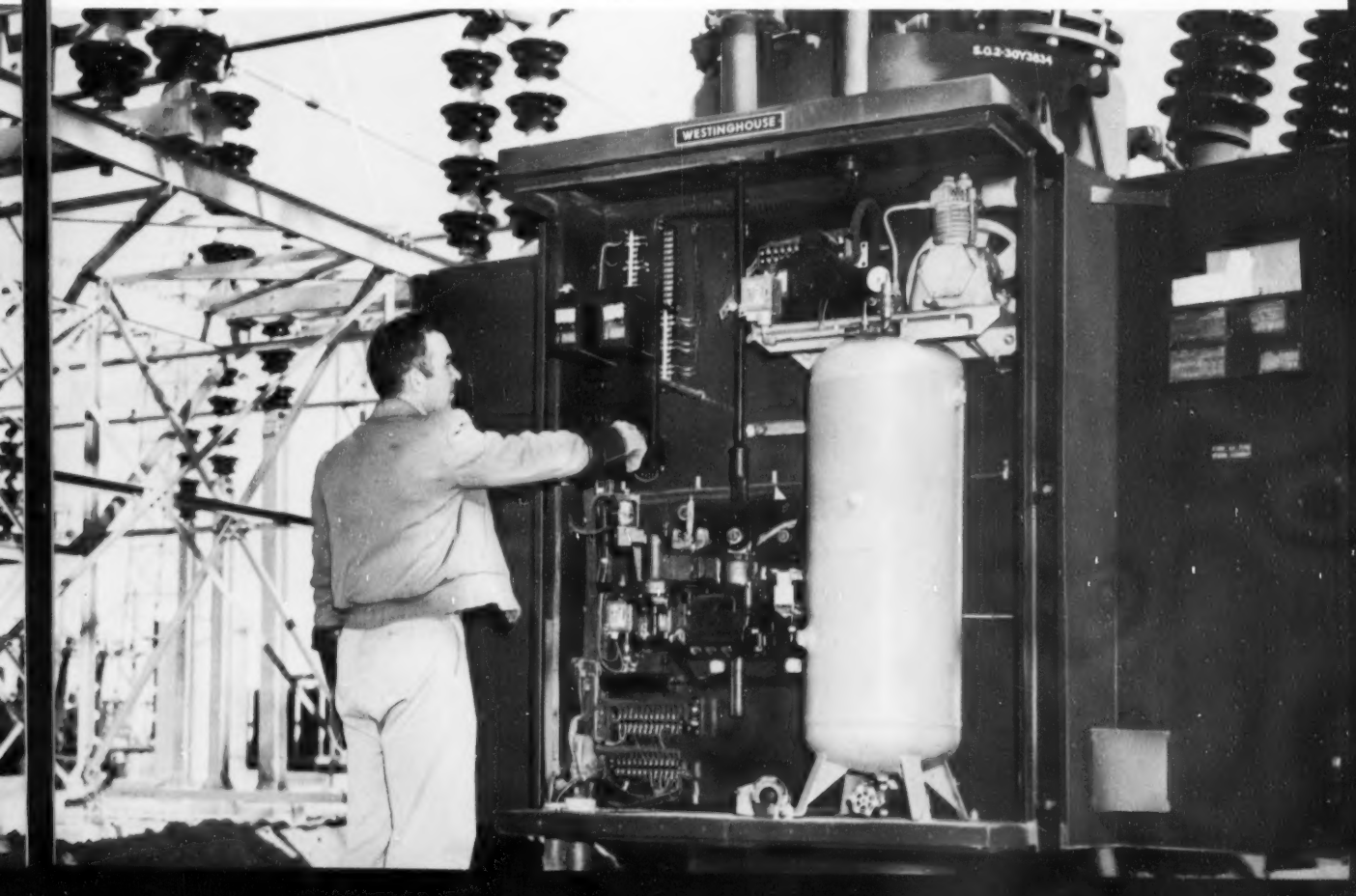
YOU CAN BE **SURE**...IF IT'S

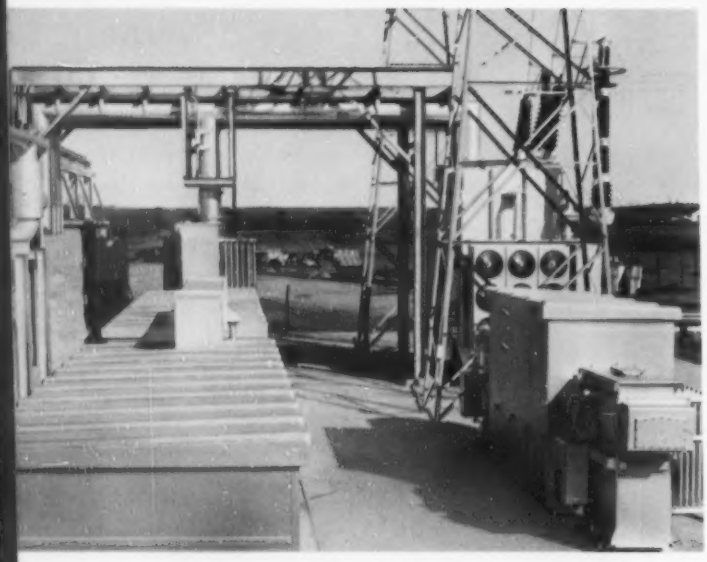
Westinghouse



Above, W. G. Steidley checks an imposing line-up of Westinghouse Type GM, 138-kv breakers. Known for their High-Power-Laboratory-verified fast fault clearing and high-speed reclosing, Westinghouse breakers aided Public Service of Oklahoma in increasing load limit and improving system stability—with a minimum investment in transmission lines and equipment.

Below, the pneumatic operating mechanism shown operates all three poles of the three-phase breaker simultaneously. Westinghouse mechanisms are mechanically trip free to insure fast parting of contacts under any condition of opening. Reclosing can be as fast as the system requires —without shock or hammering of mechanism parts.





In the upper background is a portion of the Westinghouse isolated phase bus at Public Service of Oklahoma's Southwestern Station. The cylindrical aluminum enclosures provide maximum mechanical strength and electrical protection. Proved Westinghouse design and construction simplify installation, reduce maintenance.

Isolated phase bus provides the ultimate in reliability

The generator terminals at Southwestern Station are tied directly to the main power transformer by Westinghouse isolated phase bus. This is Public Service of Oklahoma's first isolated phase bus installation. It is expected to last the lifetime of the generator and transformer.

The cylindrical aluminum enclosures of the bus are noncorrosive, light weight, and nonmagnetic. This type of construction provides the highest degree of mechanical and electrical protection with complete safety to operating personnel.

Resilient cork-Neoprene gasketed joints seal out dust and moisture. Insulators are designed with extra-large diameter for higher mechanical strength, with deep corrugations for greater creepage distance. The bus is usually factory assembled in large, complete sections for easy installation.

This isolated phase bus installation provides maximum reliability and requires virtually no maintenance.

Automatic operation, low maintenance . . . assure long-term economy

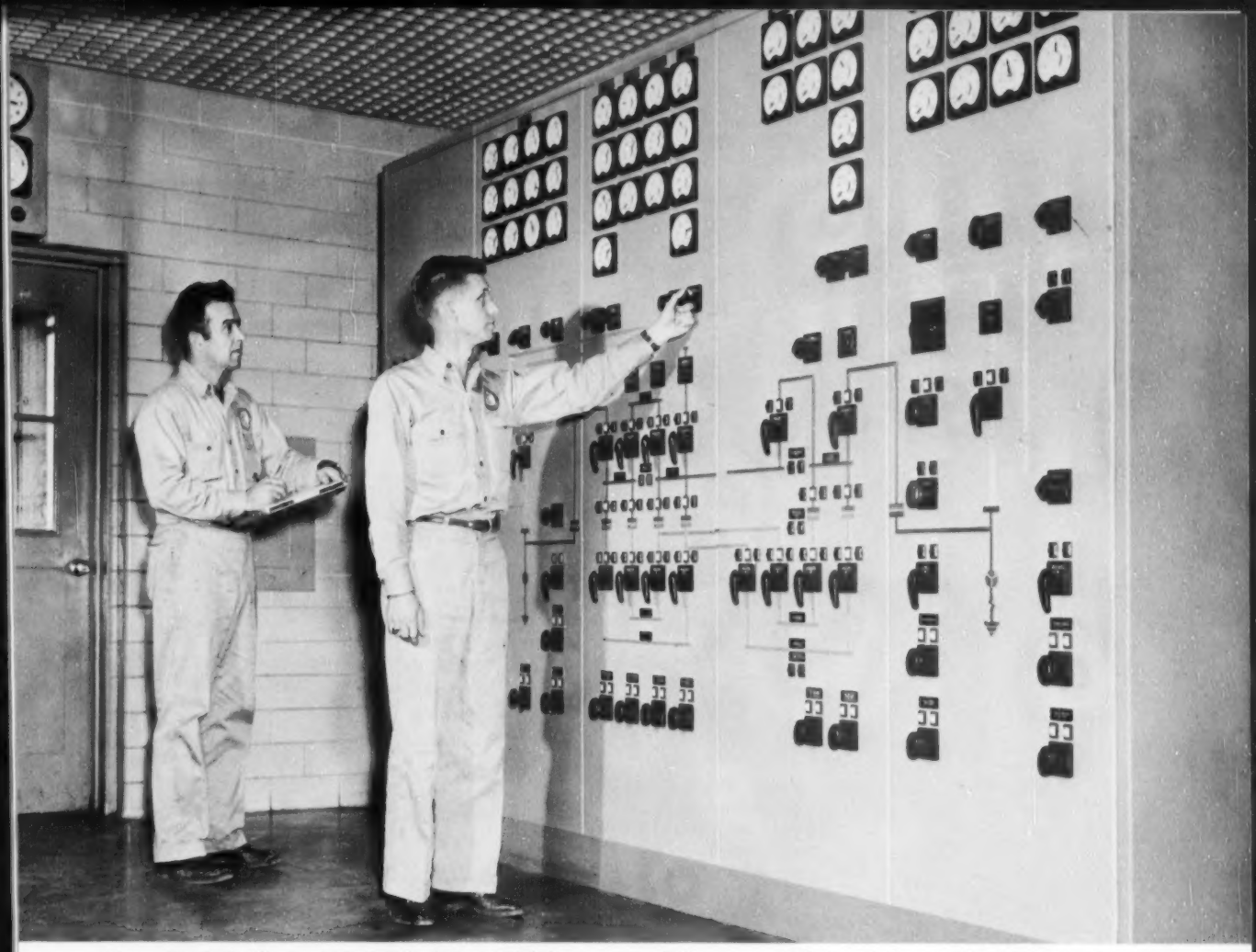
Public Service of Oklahoma, with Sargent and Lundy, carried their imaginative planning all the way through to plant control. One centralized watch station provides all controls . . . mechanical and electrical—for both generation and transmission. The Westinghouse turbine-generator follows this pattern by having throttle and all other controls tied into one central hydraulic control system. This is the main reason why this station requires only four men per shift with a single operator in the control room responsible for the boiler, generator and transmission panels. Maintenance, always expected to be low on such an installation, has been at the unusual minimum of 125 hours down time for the first 12 months of operation. Most of this was for tying in transmission lines and connecting piping.

The standard outdoor specifications of all equipment have increased total costs only a fraction of those required for conventional-type enclosures. Equipment investment and fixed costs were thus reduced and added savings on building maintenance were realized.

The simplicity of operation, minimum maintenance, and improved over-all efficiency at which Unit No. 1 is operating, are attributed in part to the excellent planning and "start-to-finish" cooperation of the utility personnel and local Westinghouse engineers.

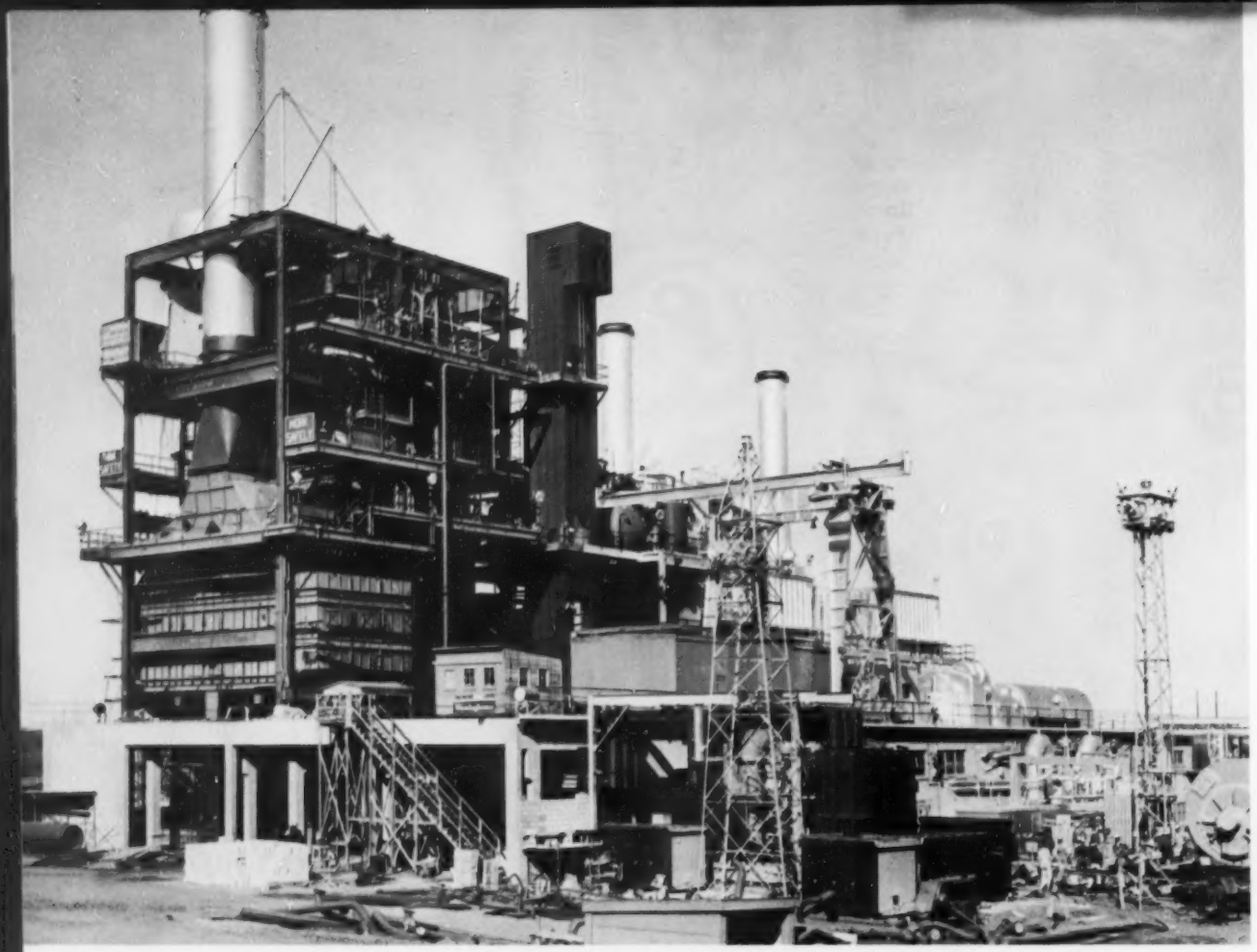
To us, the installation of Southwestern Station has established a new high in cooperative engineering and development for highest over-all results to utility, supplier and the community served.

YOU CAN BE SURE...IF IT'S Westinghouse



Above, W. G. Steidley and M. C. Wigginton of Public Service take a reading of the K-24 instruments on the Westinghouse control panel. The latest in optical improvement makes these instruments readable from as far back as 20 feet or at angles as great as 65 degrees. The glare-proof dial is never obscured by shadows.

Below, an over-all view of the centralized control room at Southwestern Station. Control, indicating, recording, regulating and protective equipment is mounted on factory assembled and tested Westinghouse duplex switchboards. The latest in modern designs are utilized for simplicity of operation and attractiveness.



Unit No. 2—"on the line" March 15, 1954

Unit No. 2 at Southwestern Station, shown above under construction, went into operation March 15. It utilized the same basic techniques proved so successful with Unit No. 1.

The only variation was that Unit No. 2 employed a single large boiler instead of the two used for Unit No. 1. Cost was relatively the same.

With the addition of Unit No. 2, Southwestern Station became a very substantial element in the planning of Public Service of Oklahoma to meet rapidly growing loads which are characteristic of the area.

The experience gained at Southwestern has proved conclusively the many advantages to be realized through maximum coordination of both equipment and man power.

YOU CAN BE **SURE**...IF IT'S Westinghouse

CP-1016

Here's detailed information. Your local Westinghouse representative has this literature at his finger tips—ask for it. Or, if you prefer, fill in the coupon and mail to Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pennsylvania.

Name.....

Title.....

Company.....

Street.....

City.....

State.....

Gentlemen: Please send literature checked below:

- ☐ Turbine-Generators (Insulation).....B-6107
- ☐ Condensers.....B-4350
- ☐ Feedwater heaters.....B-5653
- ☐ Powerhouse motors.....B-4731
- ☐ New Life-Line "A" motors...B-6154
- ☐ Motor controls.....B-6051
- ☐ Power transformers.....B-5914, B-4142-A
- ☐ Instrument transformers.....PL45-000
- ☐ Metal-clad switchgear.....B-5306-A
- ☐ Isolated phase bus.....B-5906
- ☐ Power circuit breakers.....B-5904, B-5834
- ☐ Switchboards.....DB-32-500
- ☐ Instruments.....B-4696

CP-1016

Changed Policy

(*Continued from page* 166)

electric range or water heater, the maximum is 375 ft. For a customer having one or more major appliances, the maximum is 750 ft. If two or more residential customers will be served by the extension, PGE builds lines up to 375 ft per lighting customer and up to 1,000 ft per customer per major appliance for a maximum of 2,000 ft for each customer.

Many customer-owned lines within PGE service area need replacement. In many cases insecure poles carry obsolete iron wire. Such installations are being replaced under the new policy as rapidly as possible. Customer-owned lines in good condition will not be replaced.

Customers requiring lines on their property for greater distances than the maximums listed may pay for the excess distances under various options of payment. Thus far, money spent by the company under the new policy has been a prudent investment. Primary benefits have been better service to the customer with fewer emergency service calls, particularly during storms. More load has been installed by customers who were hampered in adding load by the additional cost of revamping their lines. Considerable public relations value is felt to have been gained under the new policy. The company now can aid customers directly who needed extensions but had difficulty in finding a contractor to build these short and scattered lines.

FURNITURE COMPANY provides night lighting for customers. Lot has six 20,000-lumen mercury vapor lamps in street lighting luminaires on 30-ft steel poles, two per pole

Parking-Lot Lighting Boosts Offpeak Load

J. HOMER SHAW
Commercial Director, Business Development Dept, Utah Power & Light Co, Salt Lake City, Utah

Promotion of parking-lot lighting is paying significant dividends for Utah Power & Light Co. Total of 29 customers of this type, including supermarkets, churches, theaters and furniture stores in Salt Lake City, consume an estimated 303,000 kwhr annually of off-peak energy. Their total connected lighting load is about 211 kw.

To merchants and theater owners, spacious, well-lighted parking areas can be big factors in attracting business. Brilliant lights draw customers and make them aware stores are open at night. Safety also plays a large part in parking-lot lighting. Customers will not hesitate to park in well-lighted lots because risk of damage to their cars due to poor driver visibility is lessened. Opportunity for vandalism and theft is considerably reduced in well-lighted lots.

Neighborhood theaters with lots are excellent prospects for lighting

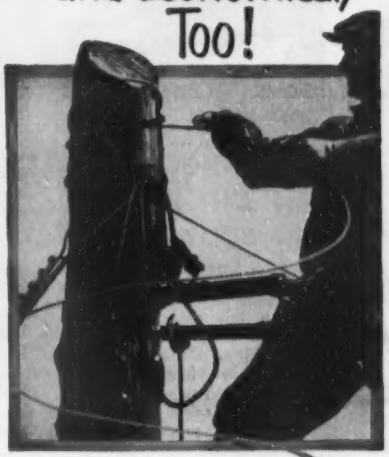
Crapo
GALVANIZED STEEL
STRAND

Strong...
to support pole structures under adverse ice and wind loadings.

Rugged...
to withstand the punishment incurred in construction and service.

Long-Life...
provided by famous Crapo Galvanized heavy, ductile, tightly-bonded zinc coatings.

-and Economical, Too!



● Each size and grade of time-proved Crapo Steel Strand utilizes the superior tensile strength of steel to the fullest advantage. Next time, specify Crapo Steel Strand for guys, messenger and overhead ground wires . . . and save on maintenance!

REINFORCE and PROTECT YOUR CONDUCTORS with Preformed ARMOR RODS

Minimize wear and chafing . . . Absorb and dissipate vibration . . . Protect against arcing and flash-overs . . . Increase holding power against slippage . . . Lessen possibilities of corrosion . . . Reduce overall maintenance costs.

Contact your jobber of Crapo Galvanized Products or write direct for further information!

INDIANA
STEEL & WIRE COMPANY
MUNCIE, INDIANA

COVER HOT LINES SAFELY

With **CHARCO'S** *dual-purpose* **BULLDOG CLAMP**

- Stop hazardous, time-consuming, outmoded taping of line hose in position.
- Use this safe, quick, sure method. Charco's combination clamp, with wider curved jaw, fits completely and easily over rubber blankets and conductors. Close-grained, rugged hardwood, carefully finished, all edges rounded, strong rust-proof spring, graduated holes to fit any size conductor.
- Separate blanket clamps and wire clamps of similar superior design also available if desired.
- Charco's Bulldog Combination Clamp, patented, available exclusively from Charleston Rubber Company and its distributors.

Write today for complete catalog of Safety products.

CHARLESTON CHARCO RUBBER CO.

CHARLESTON RUBBER COMPANY
Stark Industrial Park
Charleston, South Carolina

Other products manufactured exclusively by CHARCO include:

CHARCO FLEX-SAF RUBBER GLOVES — CHARCO FLEX-FIT PROTECTIVE SLEEVES

sales. Lights burn long hours and are justifiable to owner because they bring increased business.

Profit angle in promotion of parking lot lighting is not always necessary. In Salt Lake City, the Latter Day Saints Hospital maintains a 250-car lot, divided into two sections for visitors and staff members. Lighting consists of eight open-type 1-kw flood lights. Staff section lights burn until 1 p.m. while visitors' section lights are turned off at 10 a. m.

Churches are prospects for parking-lot lighting. Well-lighted lots assure car owners taking part in evening church activities that their cars are safe and in no danger from prowlers. These lots also aid the church's public relations by keeping cars off the street in front of neighboring homes.

'54 Called Diamond Year of Sales Opportunity

"Diamond Year of Sales Opportunity" is the designation given to 1954 by the Pennsylvania Power & Light Co. Introducing its sales plans for the year—a set of booklets detailing programs in the industrial, commercial, residential, and farm fields and in area development, distributed to the local electrical trade—the company says:

"Unusual public recognition of the services of electricity made possible through modern equipment and appliances will accrue from the concentrated promotion of Light's Diamond Jubilee.

"To take full advantage, in behalf of our customers and ourselves, of this promotional opportunity will require the best of every electrical industry sales representative in Central Eastern Pennsylvania.

"It will require the continued full cooperation between the thousands of sales allies, including manufacturers, distributors, and dealers of electrical equipment and appliances, architects, contractors, plumbers, consulting engineers, etc, and about 7,000 helpful employees of the company, all working in harmony with the company's well-trained and seasoned sales personnel."

Reports for the first months that the plan has been followed indicate its success. Widespread cooperation among the various branches of the industry has been getting results.

LINEMEN PREFER...

CHARCO FLEX-FIT SLEEVES
FOR COMFORTABLE, FLEXIBLE MAXIMUM PROTECTION

Field experience proves that linemen *more readily* accept Charco's Flex-Fit Rubber Sleeves.

WHY? Because they find them:

1 More comfortable... light-weight, dipped, seamless design gives flexibility, reduces arm fatigue...shaped shoulder stays in place for maximum protection.

2 Safer...same rubber formulation proven durable in Charco Flex-saf linemen's gloves...rigidly inspected and tested...exceeding ASTM requirements.

Made in 2 weights, 2 sizes, 2 styles... also custom made to special designs.

Your Linemen will wear Flex-Fit Sleeves. Write today for complete catalog of safety products and name of your nearest distributor.

CHARLESTON CHARCO RUBBER CO.

CHARLESTON RUBBER COMPANY
Stark Industrial Park
Charleston, South Carolina

Other products manufactured exclusively by CHARCO include:

CHARCO FLEX-SAF RUBBER GLOVES — CHARCO BULLDOG COMBINATION CLAMPS

HOW PRITCHARD'S SINGLE RESPONSIBILITY CONTRACT CAN SAVE YOU MONEY ON POWER PLANT MODERNIZATION

Your choice of Pritchard to provide the modern power installation that meets your requirements gives you more than the exceptional benefits of Pritchard's proved design, engineering and construction skills.

You receive, in addition, the many profitable advantages of Pritchard's single responsibility contract.

This master contract — which assumes full responsibility for engineering, design, drafting and construction —offers you:

(1) Knowledge of total cost before job begins.

(2) Firm guarantee of proper operation and maximum efficiency of your plant.

(3) Maximum savings from coordinated purchase of materials . . . reduction of labor costs . . . uniform control of construction.

(4) Earlier completion date which means lower construction costs *and* faster return on your investment.

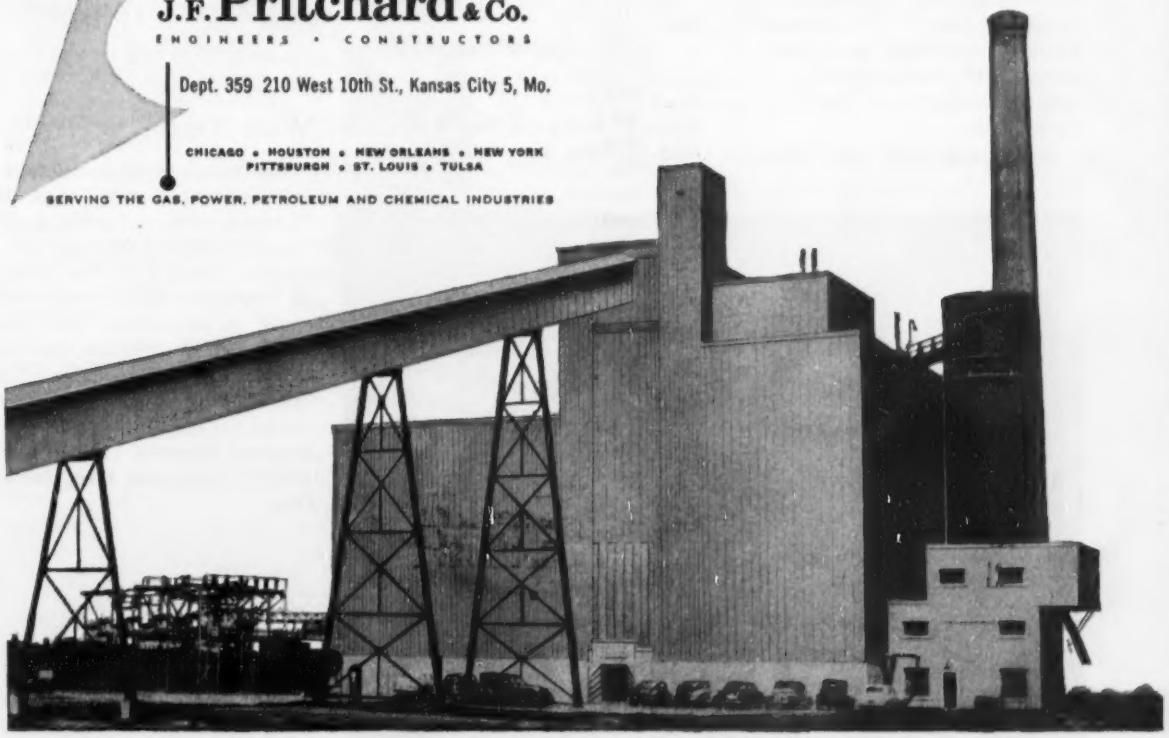
For complete information on how a single master contract can save you time, trouble and money, contact Pritchard first about your modernization or expansion plans.

J.F. Pritchard & Co.
ENGINEERS • CONSTRUCTORS

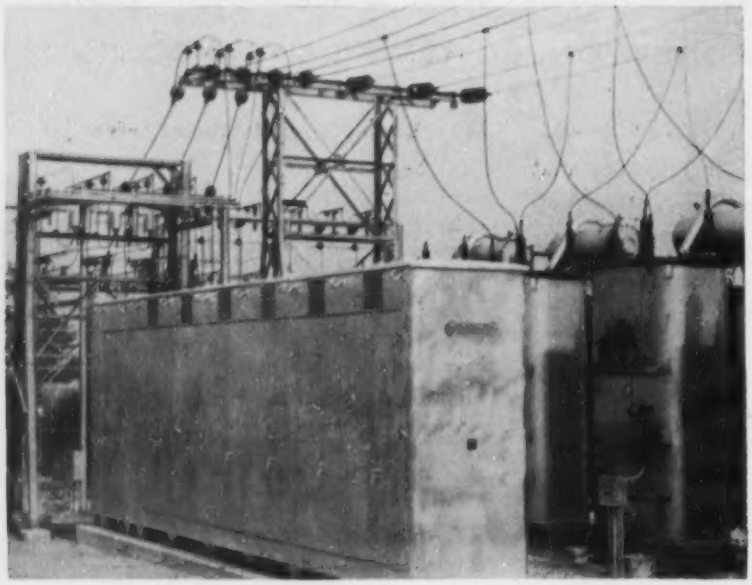
Dept. 359 210 West 10th St., Kansas City 5, Mo.

CHICAGO • HOUSTON • NEW ORLEANS • NEW YORK
PITTSBURGH • ST. LOUIS • TULSA

SERVING THE GAS, POWER, PETROLEUM AND CHEMICAL INDUSTRIES



NEW EQUIPMENT



HV Capacitors

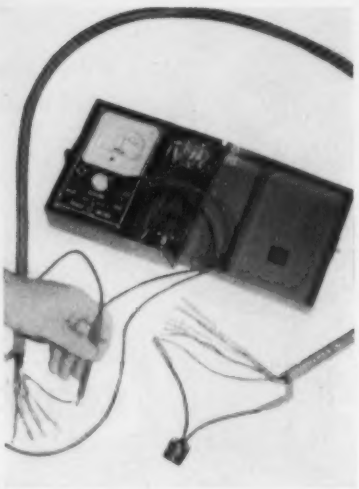
Metal-enclosed capacitor equipments, as individual compartments, are available with or without switchgear and automatic control. Complete installation is assembled by combining the required compartments. Ratings are 4,160 v, phase to phase, 600, 900, 1,200, 1,800, 2,700, and 3,600 kvar; and 4,800, 7,200, 12,470, and 13,800 v, phase to phase, 900, 1,800, 2,700, 3,600, 4,500, and 5,400 kvar.
Line Material Co, 700 W. Michigan St, Milwaukee 1, Wis.

Infrared Lamp

Infrared lamp in 500 and 1,000-w sizes has tube of fused translucent quartz. Lamp is slightly larger in diameter than a cigarette. Rated trouble-free burning life is 5,000 hr. Coiled-tungsten heating element produces full radiation almost instantly. Filament operating temperature is about 4,000F. Lamp produces visible light and energy over a wide range of wave lengths.

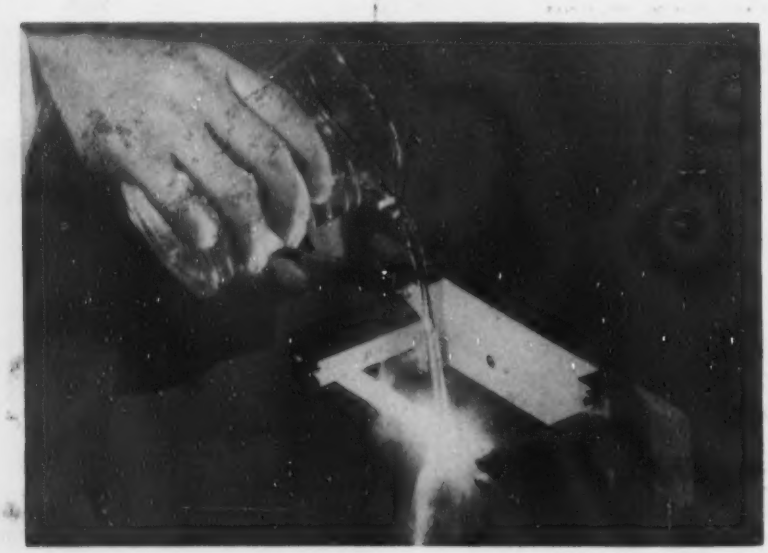
Fused-quartz lamp will withstand shock of plunging into ice water from a red heat. Weight of 500-w size is ¾ oz, and operation is on 115-125 v. Lighted length is 5 in. Metal clips on each end add 1¾ in. to overall length. Each end of lamp has flexible 6-in. lead wire.

Lighted length of 1,000-w lamp is 10 in., weight is ⅞ oz, and operation is on 230-250 v.
General Electric Co, Nela Park, Cleveland 12, Ohio



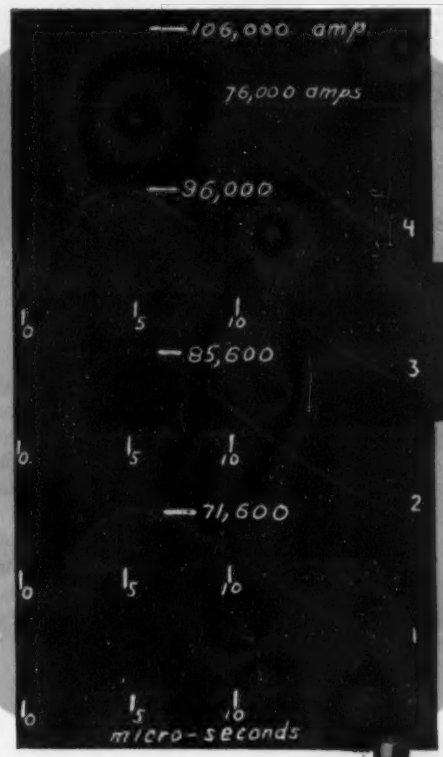
Wire Tracer

One man can trace electrical lines and cable circuits with Trace-O-Meter. To trace wires, a special numbered jumper is clipped between each wire and the conduit at one end of the line. At other end, meter is then used to check between wires and conduit. Meter pointer indicates the number of each wire, corresponding to jumper numbers. Up to nine circuits can be checked at one time.
Jackson Electrical Instrument Co, 18-20 S. Patterson Blvd, Dayton 2, Ohio



Screen Room

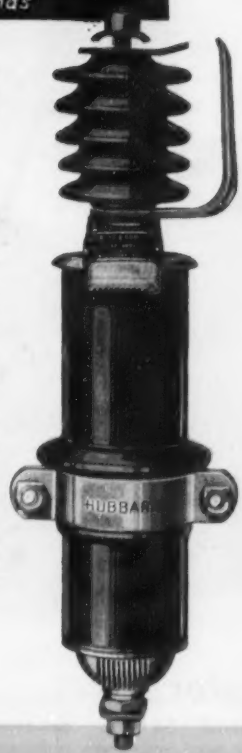
Bronze screen rooms are available 8 ft high, 5 or 10 ft wide, and 5½ to 42 ft long. Attenuation is 80 db at 50-200 kc, 112 db at 200-600 kc,



Specify Protection by AUTOGAPS

Here's Why!

Oscillogram above shows a typical high surge design test. Note that the arrester withstood four surges from 71.6 KA to 106 KA.



Available for all conditions

- Standard arresters for all distribution voltages.
- Arresters available with most self-protected type transformers . . . Specify Autogap.
- Arresters with completely insulated terminals.
- Compact fuse cutout combinations provide cost savings in initial equipment and installation.
- Special arresters for contaminated atmospheres.
- Mounting brackets available for pole, crossarm, steel structures, and new and old style transformers.

They Have Extra High Surge Capacity

Surge capacity of a Lightning Arrester relates principally to its thermal capacity and the mechanical strength of its assembly. The exclusive *twin vents* of Hubbard Autogaps offer effective relief for the gases resulting from the most extreme surges, while extra heavy steel reinforcing and fastenings provide the necessary mechanical strength.

The benefits of these characteristics are first; greater protection from extreme direct strokes, and second; long life due to the fact that there is no resistance to be depreciated by absorption of surge energy.

PLUS—Low Impulse Sparkover and Discharge Voltage

For example: Critical sparkover 9 KV arrester = 45 KV; 9 KV arrester discharge voltage during 65 KA surge = 2 KV.

Low impulse sparkover combined with low discharge voltage provides adequate protection for all transformers, whether OLD or new.

HUBBARD AND COMPANY

ESTABLISHED 1843

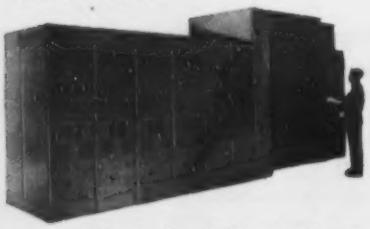
PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

"Hang the Load on Hubbard Hardware!"

ELECTRICAL CONTROL PROBLEMS ?
LET Eseco ENGINEER FOR YOUR SPECIFIC NEEDS!

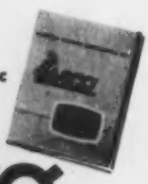
Why try to adapt your electrical control requirements to standard, mass-produced switchgear, when you can have equipment *specifically* designed for your individual need at no extra cost.

You provide installation data, equipment to be controlled, type of control desired and component preferences. Eseco engineers analyze your needs and design the equipment that meets them. Built in Eseco's modern factories, by skilled craftsmen working with precision tools, the units are critically inspected and tested each step of the way to assure positive, safe control in operation. We will be glad to analyze your requirements and furnish estimates. Write or call Electric Service Engineering Co.—today!



Section of a double-unit 4000 KVA, 13,200/480V substation, part of a system designed and built by Eseco to provide electrical control for new Caterpillar Tractor Co. York, Pa., factory.

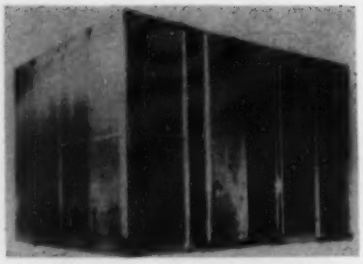
SEND FOR FREE BOOK
"Engineering for Specific Needs"



Eseco
ELECTRIC SERVICE ENGINEERING CO.
10 Third Avenue Phone: Joliet 3-9368
JOLIET, ILLINOIS

126 db at 1-800 Mc, and 100 db at 3000 Mc. Inner and outer shield screens are spaced 1⅝ in. Doors fit tightly, with copper contact figures maintaining contact. Prefabricated floors, walls, and ceilings are quickly assembled or dismantled with a screw driver and wrench.

Lindgren Screen Room, 4515 N. Ravenswood Ave, Chicago 40, Ill.



UHF Mobile Radio

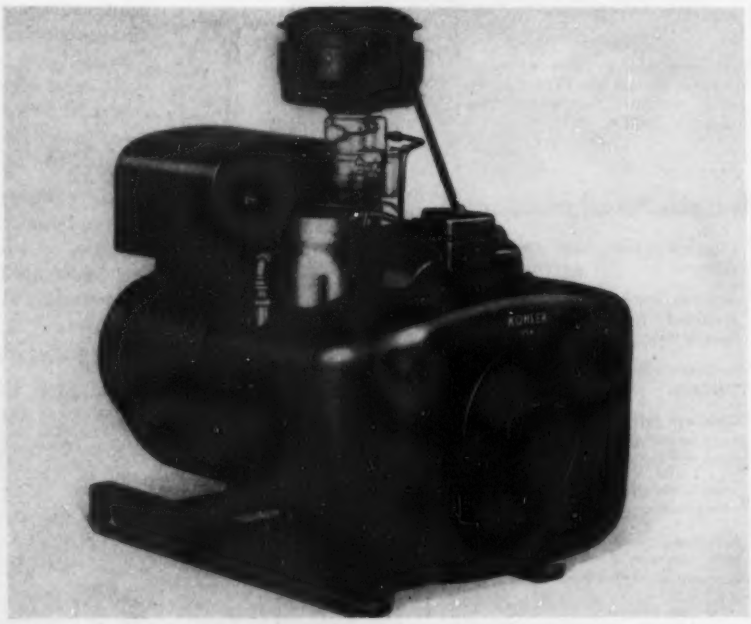
Two-way mobile radio, Type MCA-401A, is rated 12 watts at 450-460 Mc and 10 watts at 460-470 Mc. Selenium rectifiers and standard tubes are used. UHF television interference is minimized by a low-pass filter. Main assembly consists of plug-in power supply and transmitter receiver chassis.

Allen B. Du Mont Laboratories, Inc, 750 Bloomfield Ave, Clifton, N. J.

Straight-Line Clamp

Straight-line clamp has drop-forged steel (BT-5100) or aluminum body (BT-5400) and drop-forged steel keeper. Clamp will hold copper, aluminum, or ACSR conductors within its bore size range of 0.46 to 0.90 in. Use of copper or aluminum liner is recommended in steel clamps. Come-along eye is 1 x 1¼ in.

Brewer-Titchener Corp, 111 Port Watson St, Cortland, N. Y.



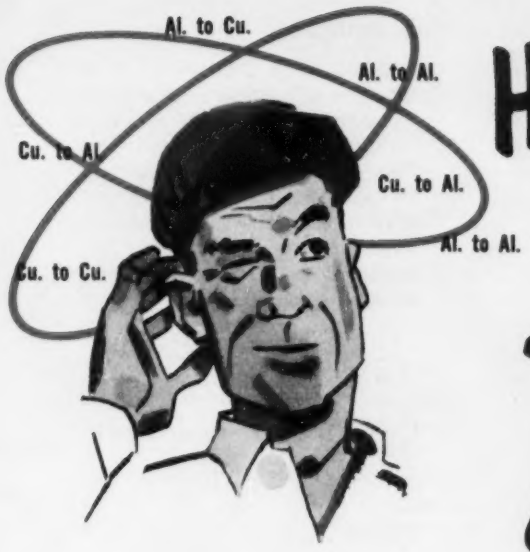
5-Kw Generator

Electric plant, Model 5RM61, rated 5 kw, is powered by 2-cylinder opposed, 4-cycle air-cooled engine. Output is 115 or 115/230 v ac, single-phase. Blower cools finned cylinder and head.

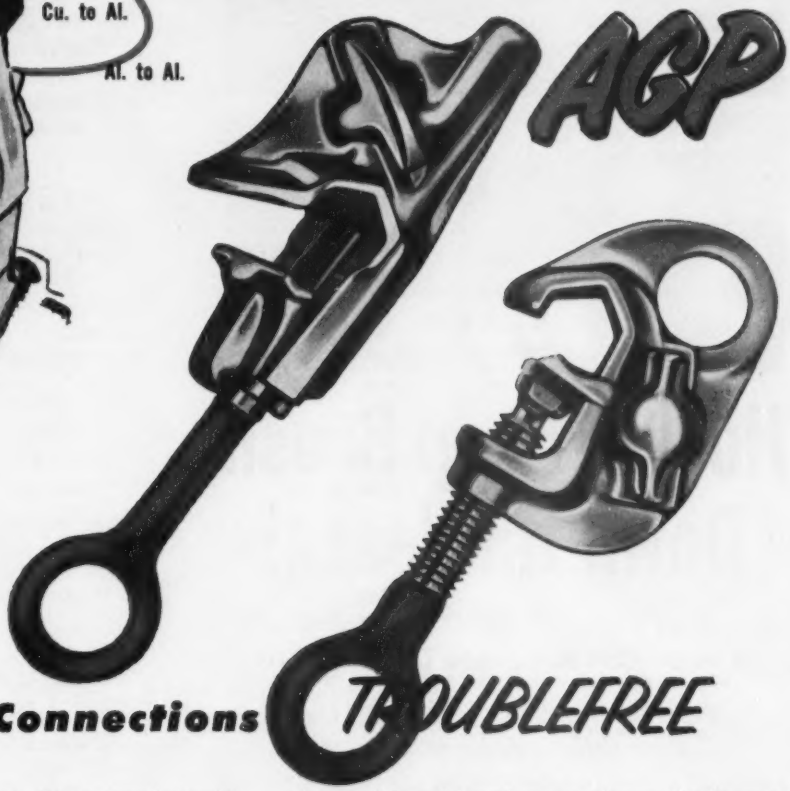
Engine has muffler, oil-bath air cleaner, and oil-pressure gauge. Plant weighs approximately 480 lb, and measures 23⅛ x 28⅛ x 32⅝ in.

Remote starting model has automatic choke and requires 12 v battery. Optional accessories include radio shielding, oil filter, vibration dampers, 55-gal fuel tank, and gas valve and carburetor for gas-gasoline operation.

Kohler Co, Kohler, Wis.



Here's the solution!



Keeps Tap Connections TROUBLEFREE

Chance AGP Tap Clamps, the first successful multi-purpose clamps, solve today's tap connection headaches. AGP Clamps can be used successfully with Aluminum to Copper, Aluminum to Aluminum, Copper to Aluminum, or Copper to Copper. That's because they are given a *properly applied coating* of high-density, fortified cadmium—to a thickness of .001". Tests undertaken by conductor manufacturers and several large power companies ... and actual field service, all prove that Chance cadmium coating resists corrosion and electrolysis in all types of connections.

Heat treated aluminum alloy bodies are light in weight. This makes them easy to handle on a clamp stick and lengthens conductor life by minimizing the effect of vibration.

Contacts stay tight—the thermal expansion of the clamp is uniform with aluminum conductor ... and since the thermal coefficient of copper is less than that of aluminum, the clamp will not deform copper conductor even under extreme temperature variations. The conductor is protected at all times.

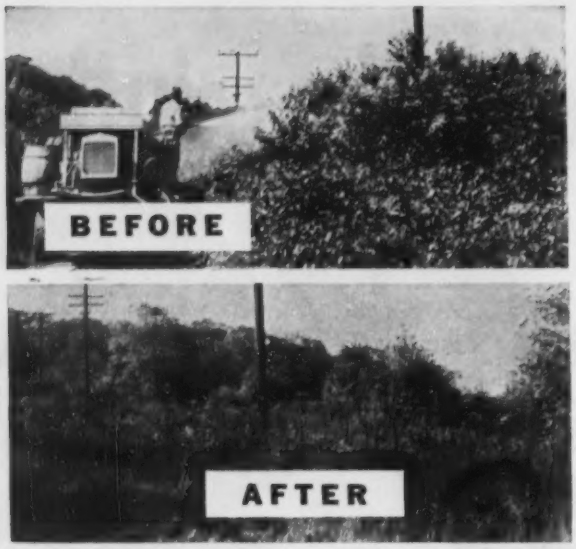
Specify Chance AGP Clamps to solve your tap connection problems. They will eliminate the possibility of error in connector applications—reduce inventories—and greatly simplify your stocking problems. AGP Clamps are available in both the Protected Connection (PC) and Perma-Grip designs.

* **CHANCE *Aluminum General Purpose – the Tap Clamp with the RED Eye Screw.***

ABC INDUSTRIES

A·B·CHANCE CO·

CENTRALIA, MISSOURI · SAN FRANCISCO, CALIFORNIA



How to Keep Brush Down for Years!

Use Du Pont AMMATE® Weed & Brush Killer—Has Minimum Drift Hazard

Controls Brush but Lets Grass Come Back Quickly to Resist Erosion

Industrial users of "Ammate" Weed and Brush Killer say that when the original spray job is done well, brush is kept under control with nothing more than an occasional spot spray years later.

Even where right-of-ways adjoin sensitive crops, like cotton, you can rely on "Ammate" to do the job safely. That's because it's not volatile—reducing spray-drift damage to a minimum.

This year, be sure to include "Ammate" in your brush-control program. It's ideal on power, telephone pipe-line and railroad right-of-ways—wherever you have a brush problem.

Free illustrated booklet describes how to control brush in right-of-ways with Du Pont "Ammate." For your copy, write Du Pont, Grasselli Chemicals Dept., D-4026, Wilmington, Delaware.

Ammate®

Weed and Bush Killer

DU PONT
REG. U. S. PAT. OFF.

On all chemicals always follow directions for application. Where warning or caution statements on use of the product are given, read them carefully.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

Connector

Connector is available in 8 sizes for 8 to 4/0 stranded copper. DG-type connector has bronze-alloy clamping members and silicon-bronze bolts. Jaws open enough, without disassembly to install main and tap conductors. Sizes 6 and 8 have optional screwdriver-slotted hex head.

Anderson Brass Works, Inc, 700 N. 41 St, Birmingham, Ala.

Coming New Equipment

Received Too Late for This Issue

Large Motors

Allis-Chalmers Manufacturing Co—For boiler-feed service, 900 hp and up

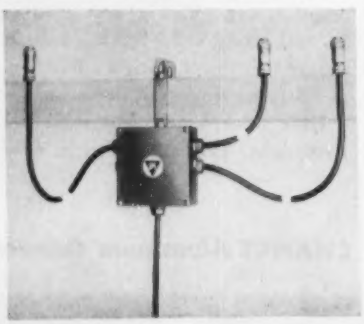
Covered Body

Morrison Steel Products, Inc—Upper structure for truck bodies covers work area

Terminals

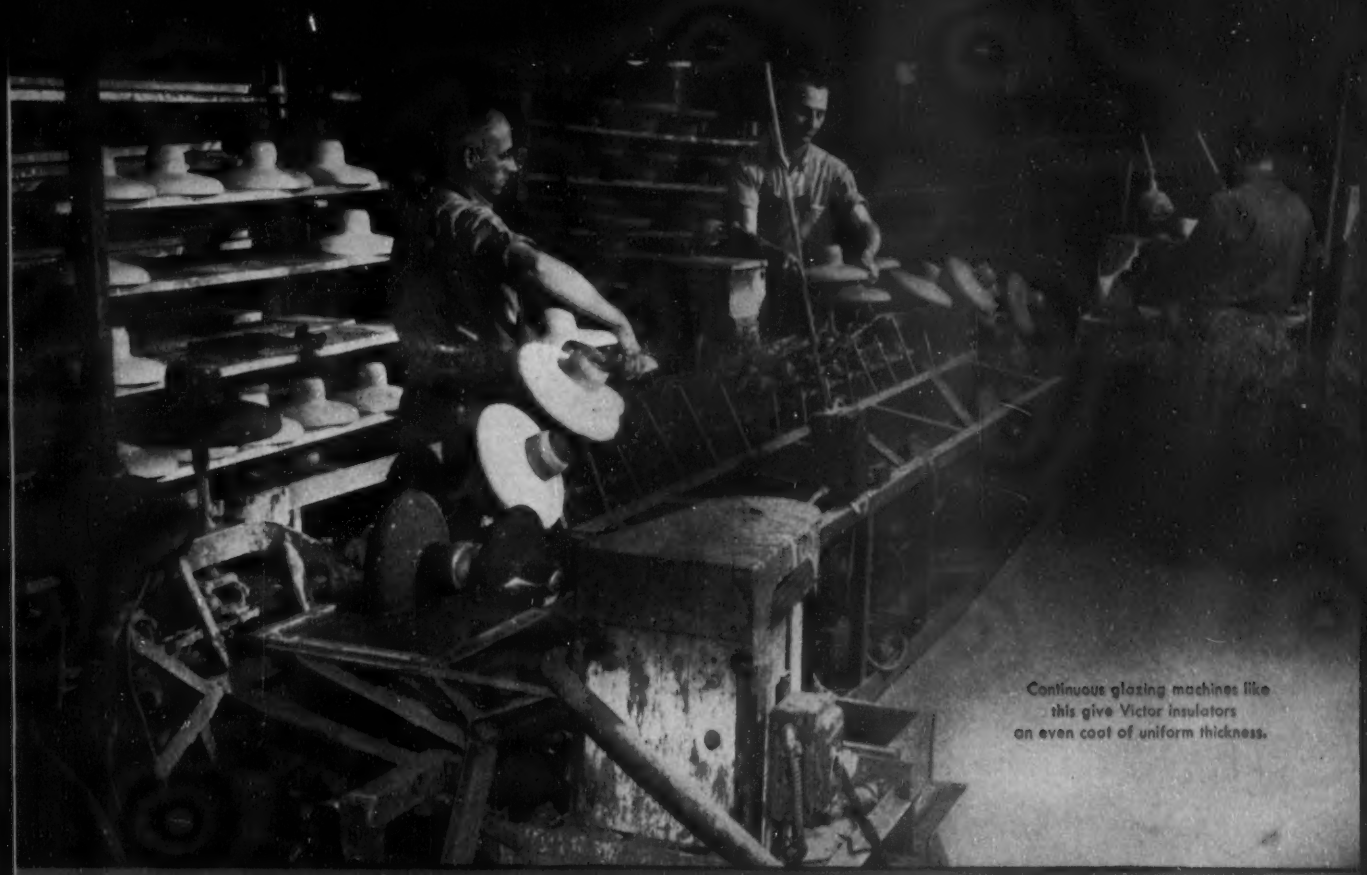
Insulated terminals are for wire sizes 8 to 4/0 and have a variety of tongue shapes and stud sizes. The 6,000-v vinyl insulation, bonded to terminal, allows use of large-size wire in restricted areas. Ampli-Bond terminals are applied in one operation with pneumatic tool.

Aircraft-Marine Products, Inc, 2100 Paxton St, Harrisburg, Pa.



Junction Box

Factory-wired junction box for NR oil switches on capacitor banks is for interconnecting switch circuits with other control circuits. Assembly has



Continuous glazing machines like this give Victor insulators an even coat of uniform thickness.

Another Reason Why—

VICTOR Makes Better Insulators

WE USE AUTOMATIC GLAZING MACHINES

PERFECTION of glaze makes an insulator self-cleaning, gives it higher mechanical strength and greater resistance to thermal variations.

By designing and building its own automatic machines, Victor gives you this glazing perfection. Each insulator is thoroughly and evenly coated with glaze. Timing is accurately controlled for maximum penetration at the interface of the insulator body and the glaze.

That's why Victor gives you smooth, perfectly glazed insulators that stand up under the most severe conditions of service . . . that cut maintenance and replacement costs to a minimum. For the full story, send for our free booklet, "The Story of Victor and Purified Porcelain."

VICTOR NO. 900 SUSPENSION INSULATOR

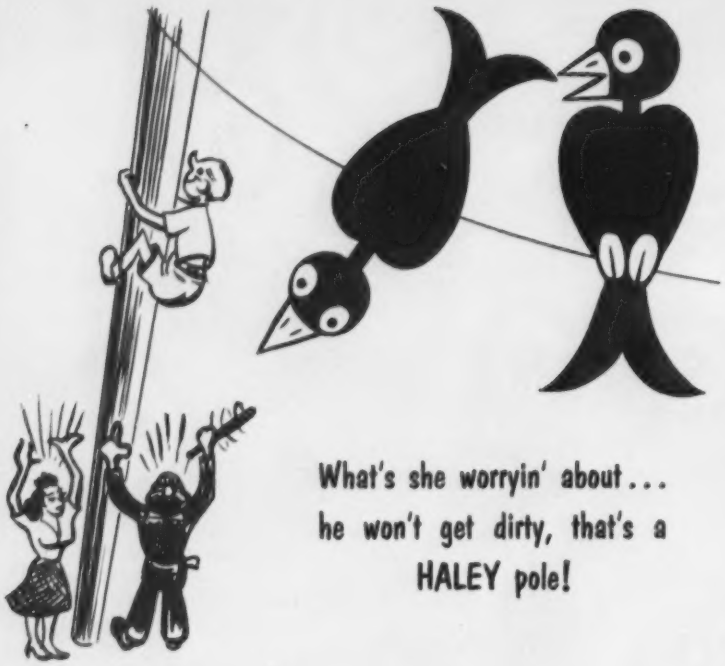
Specify

VICTOR PURIFIED PORCELAIN INSULATORS

VICTOR INSULATORS, INC., VICTOR, N. Y.

Low and High Voltage Pintypes • Suspensions • Guy Strains • Spools • Switch and Bus Insulators

• Custom Designed Porcelain • Insulator Hardware



Haley's PENTAchlorophenol TREATED

CEDAR POLES AND FIR CROSS ARMS

Light in weight and clean. PENTAchlorophenol treated in our modern plant for protection against decay, moisture and insect damage.

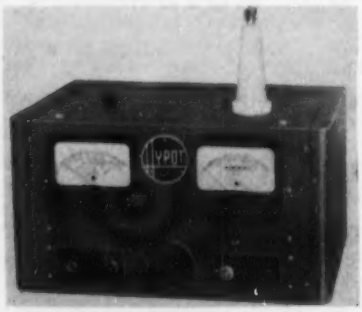
TWO Strategically Located Yards
MINNEAPOLIS, MINNESOTA
FINDLAY, OHIO

R. G. HALEY & CO.
SPITZER BLDG. TOLEDO 4, OHIO

cast aluminum box with gasketed cover, terminal block, three multi-conductor cables, and cross-arm hanger. Each cable is terminated in a plug for connection to switch receptacle.
Line Material Co, 700 W. Michigan St, Milwaukee 1, Wis.

Hook-On Meter

Hook-on volt-ammeter, Model AK-5, has ranges of 5/20/80/350 amp and 150/300/750 v ac, and will accept wires up to 2 in. diam. Knob that selects range also rotates drum-mounted scales—only meter scale in use is visible. Weight is 1¼ lb; measurements are 8⅛ x 3⅞ x 1⅞ in.
General Electric Co, 1 River Rd, Schenectady 5, N. Y.

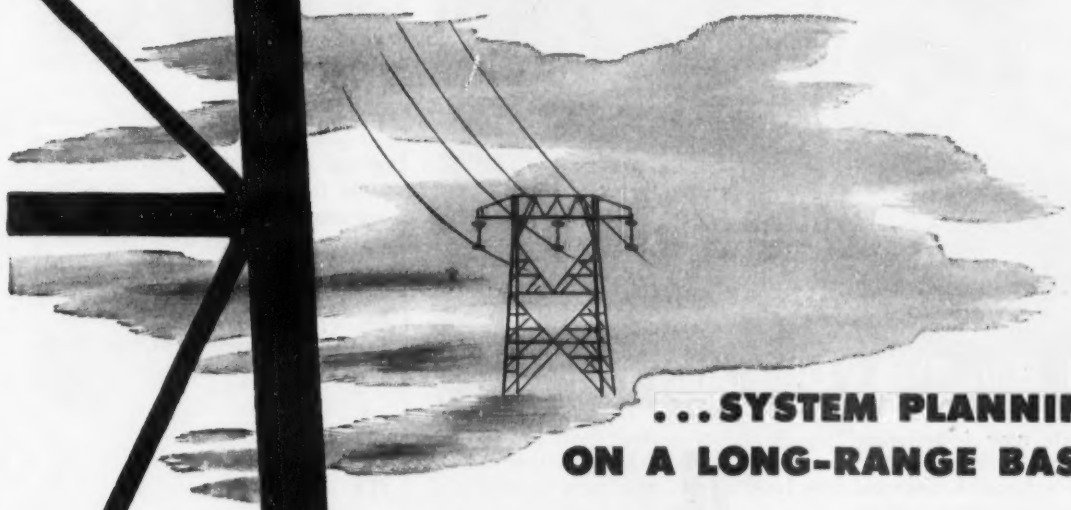


HV Tester

High-voltage testing instrument, Model 421, is rated 0-10,000 v dc at 0-500 microamp. Tester measures insulation resistance to 1,000 megohm. Output voltage and current are continuously variable, and indicated by 4½-in. meters. Neon lamp indicates flow of excessive leakage current. Case measures 17 x 9 x 11 in. Unit weighs

How Ebasco helps

the electric power industry



...SYSTEM PLANNING ON A LONG-RANGE BASIS

Through a knowledge of electric utility operations gained from almost 50 years of experience with power systems of all sizes all over the world, Ebasco offers a long-range system planning service designed to meet the specific needs of individual companies or groups of companies anywhere.

Ebasco specialists will help you find economic answers to both the engineering and service problems involved in the planning of utility system additions or improvements. Your present system is analyzed—your markets, load growth, and service requirements evaluated in light of present and future needs. These specialists help determine what new generating, transmission and distribution facilities are required—where and when to build them. All factors are taken into consideration to assure an adequate power supply, good service and optimum, over-all economy.

Our booklet—"The Inside Story of Outside Help"—describes Ebasco services and how they may be of use to you. For a copy, write or phone Ebasco Services, Incorporated, Dept. M, Two Rector Street, New York 6, N. Y.

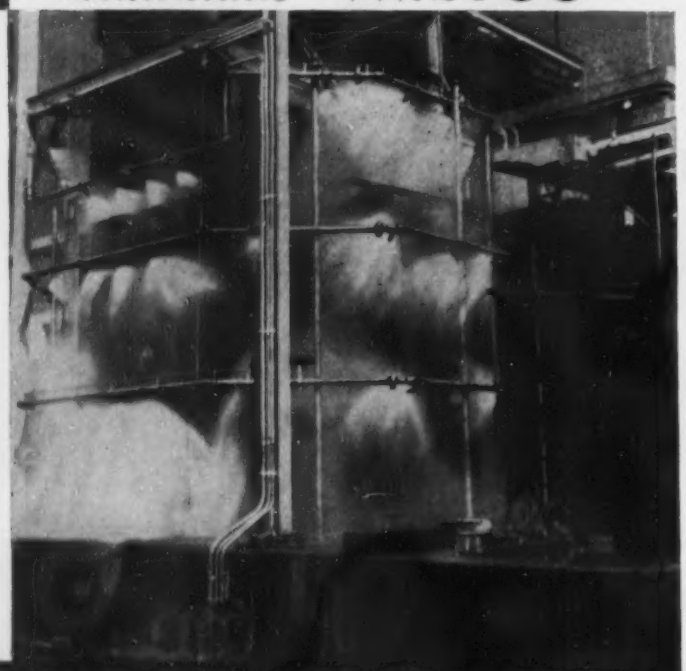
Ebasco Teamwork gets things done anywhere in the world

NEW YORK • CHICAGO • WASHINGTON, D. C.

EBASCO

Appraisal • Budget • Business Studies
Consulting Engineering • Design & Construction • Financial • Industrial Relations • Inspection & Expediting • Insurance, Pensions & Safety • Purchasing
Rates & Pricing • Research • Sales & Public Relations • Space Planning
Systems & Methods • Tax • Traffic
Washington Office

"Automatic" FIRE-FOG



Much More Than a Little More Protection

With each new installation (photo shows water flow test on 50,000 KVA transformer*) "Automatic" FIRE-FOG establishes its ability to extinguish electrical fires faster, safer and more economically than any other method.

Heat sensitive rate-of-temperature-rise thermostats detect fire within seconds of its origin. Scientifically designed spray nozzles discharge mist-fine "Automatic" FIRE-FOG throughout the fire area. Extinguishment is complete — final. Significantly, "Automatic" FIRE-FOG protection is always in readiness for instant, automatic action; now — next week — next year, or whenever fire threatens.

More detailed information on "Automatic" FIRE-FOG as pertains to your particular needs is available upon request. Send the coupon.

No Protection Here!

* Installation for Hartford Electric Light Co., So. Meadow Sta., Hartford, Conn.

Stone & Webster Engineering Corp., Boston, Mass. — Engineers and Constructors.

"Automatic" Sprinkler Corp. of Amer.
Youngstown, Ohio

Please rush copy of Bulletin 64 — Design and Application of "Automatic" FIRE-FOG

Name .....

Title .....

Company .....

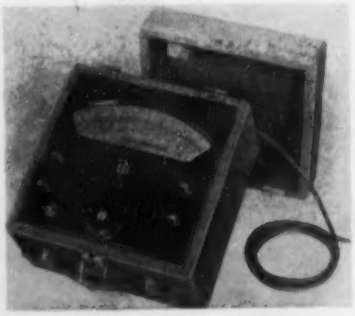
Address .....

City ..... State .....

"Automatic" Sprinkler
CORPORATION OF AMERICA
YOUNGSTOWN, OHIO
Offices in principal cities of North and South America

36 lb and operates on 115 v, 50-60 cps.

Associated Research, Inc, 3760 W. Belmont Ave, Chicago 18, Ill.



Meters

Light-pointer meter incorporates an optical system that projects a light beam from a mirror on the moving coil onto the scale. Bifilar coil suspension is claimed to withstand 500 g and overloads of 100,000%. Meters are made as sensitive as 1 microamp and 10^6 ohms per volt.

Greibach Instruments Corp, Metuchen, N. J.

HV Meter

High-voltage vacuum-tube voltmeter, Model J-1002, measures to 100,000 v peak in balanced-to-ground use, or to 50,000 v peak in single-ended use. Response is flat from 50 cps to 20 Mc.

Input capacitance is 2 or 4 mmfd. Meter uses vacuum-capacitor voltage dividers. Input circuit to peak reading dc voltmeter utilizes a shunt-series diode. Indicator is a 1-ma meter calibrated in peak kv. When used with an oscilloscope, voltage waveforms may be viewed.

Jennings Radio Manufacturing Corp, 970 McLaughlin Ave, P. O. Box 1278, San Jose 8, Calif.

Multi-Meter

Multi-range meter has automatic overload cut-out protection. Sensitivity is 20,000 ohms per volt on ac and dc scales with 50 microamp movement. Scale has anti-parallax mirror. Single switch selects the 39 ranges. Ranges extend from 3 to 5,000 v ac

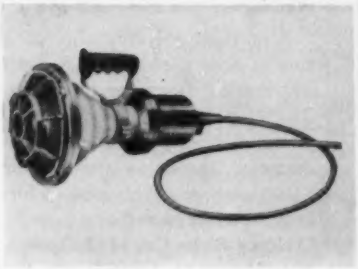
and dc, 50 microamp to 10 amp dc, and 0 to 20 megohms. Accuracy on dc is 1.5%; on ac, 2.5%. Dimensions are 8¼ x 5⅞ x 3⅛ in. Weight is 3½ lb.

Compagnie Generale De Metrologie, Chemin De La Croix-Rouge, Annecy, France

Bridge

Capacitor-resistor bridge, Model BF-60, measures capacitors 0.00001 to 1,000 mfd and resistors 100 ohms to 5 megohms. Bridge measures capacitor power factor 0 to 50%, and provides polarizing voltages of 25 to 450 v dc. Weight is 8¼ lb; measurements are 5½ x 7 x 10 in.

Cornell-Dubilier Electric Corp, South Plainfield, N. J.



Floodlight

Portable explosion-proof floodlight has Underwriters' approval for use in all hazardous areas. Interior air pressure greater than surrounding air pressure prevents any gas from entering the fixture. If fixture is damaged, a switch extinguishes the lamp at 3½ psi. Molded and machined plastic in fixture base is heat resistant to 250F. Unit passes Underwriters' drop test.

Safe Lighting, Inc, 91-03 Astoria Blvd, Jackson Hts, N. Y.

Alarm System

Alarm system reports malfunction of unattended equipment and warns of telemetering breakdowns. Basic system consists of battery-powered tone transmitter and a frequency-selective receiver, interconnected by a telephone circuit.

Addition of coding unit at transmitter will classify type of failure involved. Information is transferred as

RIPLEY SUNSWITCH

lights the way!

"double-duty 60"

SUNSWITCH

With the introduction of the SUNSWITCH "double-duty 60", the Ripley Company has again demonstrated proof of its 18 year leadership in the field of photoelectric Street-Lighting Controls.

This economically installed and maintained 60-ampere SUNSWITCH is setting new standards of dependable performance and reliability.

When lights are needed . . . regardless of time of day, season or weather conditions . . . Ripley SUNSWITCH takes over—providing safe, dependable Street-Lighting—automatically. Let Ripley help you light the way.

SEND FOR BULLETIN S-60 TODAY!

Superior through Research

RIPLEY ESTABLISHED 1926

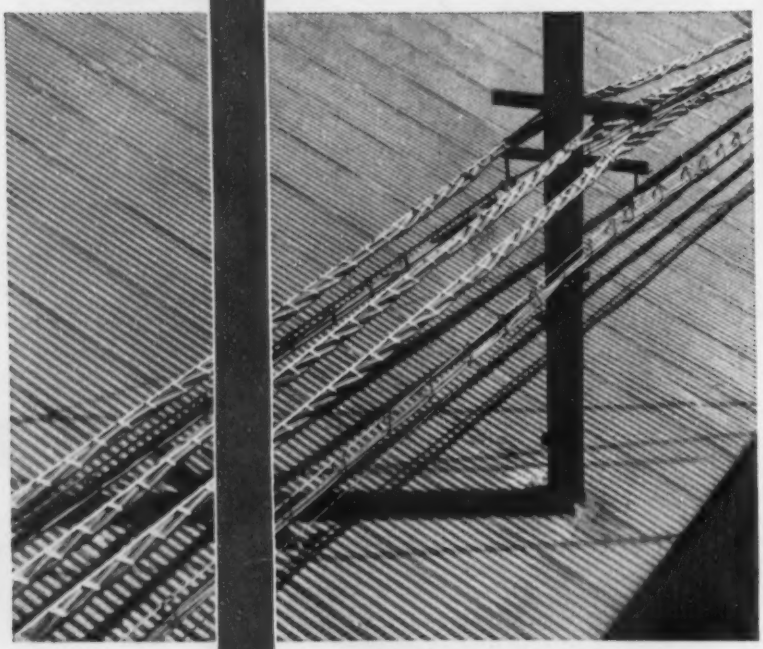
RIPLEY COMPANY, INC.

MIDDLETOWN, CONNECTICUT

an ACCO product

PAGE

Stainless Steel Strand



for Severe Service Conditions

• The photograph above shows just one example of how PAGE Stainless Steel Strand is ideal for applications involving rugged service conditions.

Here, PAGE Stainless Steel Messenger Strand, with stainless steel lashing tapes, supports perfectly a series of insulated conductors through a highly corrosive fume area above a steel cleaning house.

PAGE Stainless Steel Strand is equally versatile for ground, guy and catenary applications. Its higher tensile strength, corrosion-and-abrasion resistance, elastic limit and strength-to-weight ratio make it your first choice! And—its lower cost *per year* of use means long-range economy.

ACCO

Page Steel and Wire Division
AMERICAN CHAIN & CABLE

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Portland, San Francisco, Bridgeport, Conn.

PAGE Strand

a continuous 1,000-cps tone, or an interrupted 1,000-cps tone coded to identify character of failure. Transmitter will simultaneously accept reports from two or more areas of failure.

Hammarlund Manufacturing Co, Inc, 460 W. 34th St, New York 1, N. Y.

Cable Reel

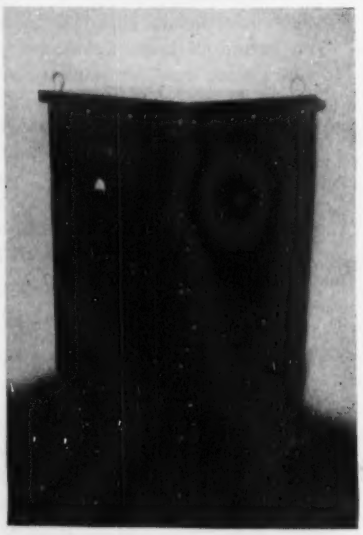
All-welded steel cable reel, No. 480, is designed for handling heavy flexible cable and wire. Single handle locks tubular coil supports in position. Open construction permits tying of coil before collapsing reel for removal. Coil support members are 8½ in.-diam semi-circles. Coil inside diameter is 26 in.

Hykon Manufacturing Co, 163 E. State St, Alliance, Ohio

Wire

Semi-rigid polyvinyl-choride insulation is now used on 22 S Teleframe distributing frame and jumper wire. The electrical and mechanical properties of Plastite allow smaller outside diameter. Insulation is tough, abrasion and flame resistant, and colors are bright and permanent.

Whitney Blake Co, 1565 Dixwell Ave, New Haven 14, Conn.



Static Frequency Converter

Static frequency converter provides 360-cycle square-wave current at 600 v for high-frequency operation

Give the GUY a CHANCE
the CHANCE "Blackfoot"
Holds more—
Goes down faster

KING SIZE THIMBLEYE
The extra large eye of the Chance Blackfoot accommodates a turning bar big enough to make hand installation easy, and fits all hole boring machine adapters.
PITCH CONTROLLED
This accurately pitched, fast cutting blade really goes down fast. Every size anchor is individually "pitch controlled."
SMALLER HUB
The smaller hub on Chance Screw Anchors means less friction—easier installation. Less earth is disturbed during installation. That's why the Blackfoot has greater holding power.

CAN BE INSTALLED BY MACHINE TO CUT LINE CONSTRUCTION COSTS . . .

Power companies trying to trim costs can profit by the experience of a Florida Utility where the use of the big Chance 15 inch Screw Anchor was combined with machine installation to reduce anchoring costs.

The use of the fifteen inch Blackfoot permitted one anchor to take the place of several smaller ones. This added up to a considerable saving in material costs. Speedy machine installation—with fewer anchors to install—slashed installation time to a small fraction of what was previously required.

How did these anchors hold?

Company personnel conducted their own pull tests to determine the holding power of these Chance Anchors. The dynamometer showed *no* creep at 22,000 pounds!

You can protect your investment in line construction by specifying Chance Anchors for your guys. They really hold the load!

ABC INDUSTRIES

A·B·CHANCE CO.

CENTRALIA, MISSOURI
SAN FRANCISCO, CALIFORNIA

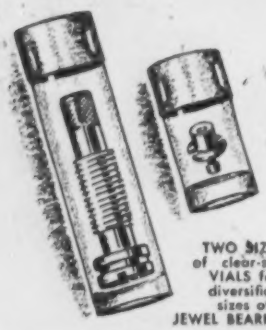
ANCHORS • GUYING FIXTURES • LINE CONSTRUCTION TOOLS • CONDUCTOR CLAMPS
GROUNDING EQUIPMENT • HOT LINE TOOLS • HIGH VOLTAGE SWITCHES • CUTOUTS

CA54-8

New

JEWEL BEARING SERVICE PAK

HERE'S MAXIMUM ASSURANCE OF TOP BEARING SURFACE CONDITIONS — when you use these NEW Jewel Bearing Service Paks.



TWO SIZES of clear-sight VIALS for diversified sizes of JEWEL BEARINGS

These clear-vision SERVICE PAKS with the inner VIALS allow immediate checking of quantity available. All possibility of blemishes on the polish, scratches, ruptures, or foreign matter present — is eliminated.

All Eastern Specialty Jewel Bearings are now packed in the complete SERVICE PAK. Maximum protection at minimum cost.

Write for Complete Information

EASTERN SPECIALTY CO.
PHILADELPHIA 40, PA.

of fluorescent lamps. Converter, rated 5 kw, is designed for television and radio studios, luminous ceilings, and libraries.

Converter will start and operates fifty 96T8 or 96T12 lamps with 0.33 microfarad capacitor in series with each. Single knob controls lamp current to 300-500 ma. Input is 480 v, 60 cps, 3 phase. Unit weights 1350 lb and measures 31 x 25½ x 55 in. **General Electric Co, 1 River Rd, Schenectady, N. Y.**

Induction Motors

Weather-protected squirrel-cage induction motors, rated 250 hp and larger, have silicone insulation. Silicone enamel is baked on exposed metal parts; parts subject to air abrasion are stainless steel. Sil-Clad motors are designed for damp, moist, or steamy conditions, seacoast locations, or chemically-active atmospheres. **Electric Machinery Manufacturing Co, 800 Central Ave, Minneapolis 13, Minn.**

MORE NEW PRODUCTS

about which you should know

General Electric Co, 1285 Boston Ave, Bridgeport 2, Conn., has CLF **cartridge fuses,** having high interrupting capacity, for 250 and 600 v, 6 to 200 amp . . . Fidelity Chemical Products Corp, 470 Frelinghuysen Ave, Newark, N. J., has Super X-Var 622 **wire stripping solution,** stronger and faster than X-Var 306.

Stearns Magnetic Inc, 690 S. 28th St, Milwaukee 46, Wis. has disc **magnetic brakes** for 1/20 to 2 hp motors . . . Union Twist Drill Co, Athol, Mass. has crankshaft **drill point grinder.**

Multi-Amp Corp, 10 Third St, Newark, N. J. has **high-current testing instrument** with timer, rated 1 kva, 0-500 amp . . . George L. Nankervis Co, 19255 W. Davison, Detroit 23, Mich. has 60 cps **stroboscopic light.**

Unistrut Products Co, 1013 Washington Blvd, Chicago 7 has **spot insert** for concrete, No. P-3245 . . . Taylor Electric, Inc, 15460 Dale, Detroit 23, Mich. has thermoplastic **wiring duct** that eliminates lacing.

CATALOGS • BULLETINS

● **MICROSWITCHES:** The following publications are available from Minneapolis-Honeywell Regulator Co, Freeport, Ill.:

Data Sheet 69 This sheet describes enclosed reset switch assemblies. These assemblies provide sustained contact after plunger force has been relieved.

Catalog 90 Engineering data on 29 mercury switches for ac or dc industrial and commercial applications are covered in this 12-page catalog.

● **LIGHTING POLE:** Folder LS-15 shows three designs of Monotube lighting poles especially designed for shopping center parking lots. Union Metal Manufacturing Co, Canton 5, Ohio

● **CONTROL CENTERS:** A 24-page booklet, "Control Centers by Clark," describes centralized electrical control systems which group combination motor starters and auxiliary control equipment at one location. Clark Controller Co, 1146 E. 152nd St, Cleveland 10, Ohio

● **MAINTENANCE CONTROL:** A 6-page bulletin describes step-by-step procedures and 10 different order forms for varying requirements, such as maintenance request and order; job scheduling and assignment; and cost, material and tool crib control. McCaskey Register Div, Victor Adding Machine Co, 101 W. 31st St, New York 1, N. Y.

● **THERMOSTAT:** Surface thermostat, Type KSB, is described in a data sheet. This thermostat operates over any 90 F range between 15 and 240 F, operates on a ±3 F differential and is rated for 2 amp at 220 v ac. Ing. Richard Fonovits K. G., Ranftlgasse 17, Vienna 17 or Austrian Trade Delegate, 31 E. 69th St, New York 21, N. Y.

● **AIR CONDITIONING:** An 8-page booklet describes air conditioning units of 1, 1½, and 2 hp. These systems are designed to fill the gap between single-room units and complete central systems. Model 120 is for 2 rooms; Model 180 for 3 rooms; and Model 250 is for 4 rooms. Remington Corporation, Auburn, N. Y.

● **FLEXIBLE METAL HOSE:** Bulletin EH-50, 8-pages, describes three types of flexible metal hose for diesel engine installations. American Brass Co, Waterbury 20, Conn.

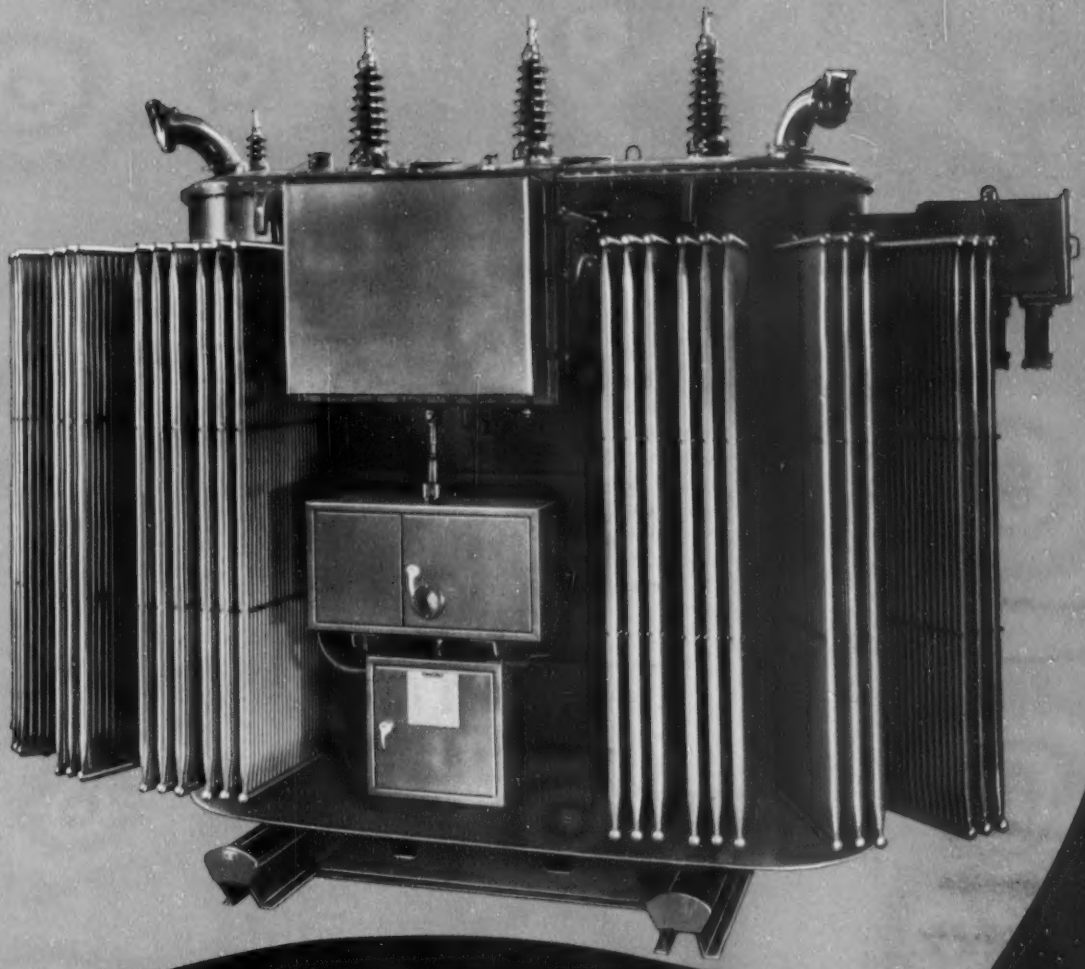
● **MOBILE CRANES:** An 8-page bulletin describes mobile industrial cranes containing many safety devices. Coles Cranes, Inc, P. O. Box 942-E, Joliet, Ill.

● **FACTORY AIR CONDITIONING:** A 4-page bulletin describes 2-hp air conditioning units designed for roof mounting. Kritzer Products, 1232 W. LeMoyne St, Chicago 22, Ill.

● **MOTOR SPEED CONTROLS:** The General Radio Experimenter for December, 1953 features five new speed controls for operation of dc motors from an ac line. With the addition of types 1701-AM, 1703-A, 1702-M, 1704-A, and 1705-A controls, available controls now extend from 1/15 to 1½ hp. General Radio Co, 275 Massachusetts Ave, Cambridge 39, Mass.

● **ELECTRIC CLUTCH:** Bulletin No. 6158, 6 pages, describes 3 models of small electric brakes and 3 models of small electric clutches. Static torque ratings are 8, 60, and 240 lb-in, and operate on 6 to 15 w with coils available from 6 to 90 v dc. Warner Electric Brake & Clutch Co, Beloit, Wis.

● **POLE LIGHTING:** Corrections and additions for Catalog PB-53, Thompson Servisafe Units for Pole and Wall Mounted Luminaires, are available from Thompson Electric Co, 1111 Power Ave, Cleveland 14, Ohio:



20,000 KVA *three phase* Pennsylvania LOAD RATIO CONTROL Transformer

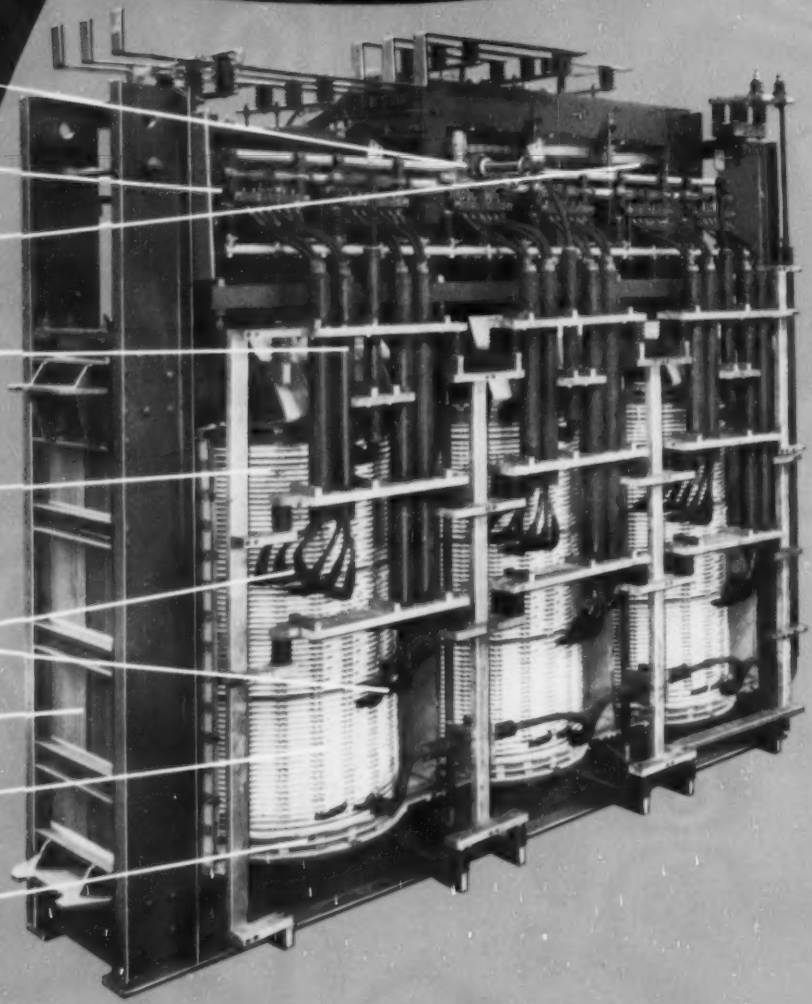
See next page for inside story

The low voltage windings of this Pennsylvania transformer are provided with tap changing underload equipment for plus and minus 10% regulation in 32-⅝% steps. Self-cooled, the transformer has a rating of 20,000 Kva. However, there are provisions for the future installation of fans to increase the rating to 25,000 Kva. The transformer is designed to step down a transmission voltage of 69,000 volts to 13,200 volts.

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division **CANONSBURG, PA.** *Greater Pittsburgh District*

Inside a 20,000 KVA *three phase* Pennsylvania LOAD RATIO CONTROL Transformer



Straight-line, no-load tap changer on high voltage side.

Preventive auto transformer permits uninterrupted current flow during tap changes.

Series transformer reduces current of load ratio control mechanism.

Well-insulated tap leads, rigidly supported in heavy pressboard tubes, are connected to the straight-line, no-load tap changer.

Coils are precompressed with a force equal to the highest short circuit stress and built into the transformer at that compressed dimension. This prevents mechanical distortion of the coils if short circuit stresses occur.

Two sets of taps per coil assure excellent electrical and mechanical balance in the windings.

Five-legged core reduces height of transformer.

Continuous pancake winding in High Voltage coils. Helical winding in Low Voltage coils.

Line ends of coils are heavily insulated to provide extra protection against surge voltage stresses.

For exterior view of this transformer, see other side.

pt

20,000 Kva. Three phase, 60 Cycles, 55°C. Temperature rise. High Voltage: 69,000Y volts. Low Voltage: 13,200 Delta volts. Low Voltage windings provided with tap changing underload equipment for plus and minus 10% regulation in 32-⅝% steps.

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division

CANONSBURG, PA. *Greater Pittsburgh District*

Price List No. PB-54 This price list, 16 pages, is effective February 1, 1954. Two catalog sheets Pages 23 through 26 for Catalog PB-53, describe Pacific Car and Foundry poles.

Correction slip A correction slip applies to Catalog PB-53.

● **CONTROL CENTERS:** A 12-page bulletin, No. 170, describes centralized combination motor starter centers, giving size, rating, and ordering data. Arrow-Hart & Hegeman Electric Co, 103 Hawthorn St, Hartford 6, Conn.

● **SOLENOIDS:** A catalog sheet contains features, power curves, drawings and other technical data on four basic models of stock solenoids. Soreng Products Corp, 9555 Soreng Ave, Schiller Park, Ill.

● **TEST INSTRUMENTS:** A 4-page catalog, MA-154, gives electrical specifications, applications, dimensions, and description of portable high-current calibrating and test instrument for testing electrical protective devices. Multi-Amp Corp, 10 3rd St, Newark 7, N. J.

● **TELEVISION:** A folder is available containing sheets on industrial and broadcast television equipment, such as: Vidicon camera, camera 100-A, 50-A, and 300-C, sync generator 400-A, switching-fading unit 500-A, audio-video mixer 200-A, and price lists. Dage Electronics Corp, 69 N. 2nd St, Beech Grove, Ind.

● **SOLDERING IRONS:** A 4-page catalog, No. 106, shows 40 models of electric soldering irons, 25 to 700 w. Hexacon Electric Co, 206 W. Clay Ave, Roselle Park, N. J.

● **CONNECTORS:** A brochure describes 40 types of Lev-O-Lock locking-type caps, receptacles, and cord connectors having 2, 3, or 4 conductors. Leviton Manufacturing Co, Brooklyn, N. Y.

● **BIN LEVEL INDICATORS:** A 20-page catalog gives installation data, wiring diagrams, and descriptive information on pressure-actuated bin level indicators suitable for indicating or controlling the level of granular, pulverized, or semi-liquid materials. Bin-Dicator Co, 13946-70 Kercheval Ave, Detroit 15, Mich.

● **IEEM:** A 24-page brochure outlines IEEM activities, membership classification, purpose, and publications. The institute is concerned with equipment to simulate the physical environment for testing the effects on men, material, and equipment. Institute of Environmental Equipment Manufacturers, 30 Church St, New York 7, N. Y.

● **ELECTRIC HOIST:** Bulletin QL, 6 pages, gives performance and safety features, drawings, specifications, and dimensions for 17 electric hoists and hoist accessories. Coffing Hoist Co, Danville, Ill.

● **Db METER:** An engineering data sheet gives information on round and square watertight 1½ in. db panel meters constructed to government specifications. International Instruments Inc, P. O. Box 2954, New Haven 15, Conn.

● **MOTORS:** Condensed price list, form 943, dated February 1, 1954 covers many types of motors from 1/6 to 400 hp and motor controllers. Century Electric Co, 1806 Pine St, St. Louis 3, Mo.

● **TRENCHER:** The Model 140 trencher, which digs up to 5½ ft deep and from 18 to 30 in. wide, is described in an 8-page bulletin. Cleveland Trencher Co, 20100 St Clair Ave, Cleveland 17, Ohio.

● **ALTERNATORS:** Publication No. 21063, 4 pages, explains the Amplidex system of control for self-regulating alternators. This amplifying system maintains regulation to ±2½% and is used for alternators up to 150 kw. Brush Electrical Engineering Co, Ltd, Loughborough, England.

● **ELECTROMETERS:** Vacuum-tube electrometers and their application for potential, current, capacitor, and resistance measurements are covered in an 8-page catalog. Keithley Instruments, 3868 Carnegie Ave, Cleveland 15, Ohio

● **PRIVATE CALL SYSTEM:** A 6-page brochure, "The P-A-X Code Call Service," describes how key employes can be quickly reached anywhere in the plant by means of special signaling devices, visual or sound, that are part of an internal business telephone system. Automatic Electric Co, 1033 W. Van Buren St, Chicago 7, Ill.

● **VOLT-AMMETER:** Amprobe catalog No. 134, 4 pages, describes several new snap-around volt-ammeters. Meters are featured with full-scale ranges of 6 to 600 amp and 150 to 600 v ac. Also shown are 10X current-sensitivity multipliers. Pyramid Instrument Corp, Lynbrook, N. Y.

● **CUSTOMER ACCOUNTING:** A 16-page brochure, "Public Utility Customer Accounting," describes a use of the intermediate-sized electronic data processing machine, Type 650, for bill computing and analysis. International Business Machines Corp, 590 Madison Ave, New York 22, N. Y.

● **FLOODLAMP:** A catalog sheet, Bulletin 14, describes the 300 and 500 w R40 weatherproof floodlamps. Radiant Lamp Corp, 300 Jelliff Ave, Newark 8, N. J.

● **POWER HOLE DIGGER:** Bulletin 40, 8 pages, describes the all-purpose digger used for pole setting, soil sampling, mineral prospecting, tree planting and other uses. This digger is supplied with self-contained power plant or for use with truck power take-off. Acker Drill Co, Inc, Scranton 3, Pa.

● **FOUNDRY EQUIPMENT:** A 40-page book, No. 2423, describes conveyor, sand, mold, core, casting and other equipment for mechanization of ferrous and nonferrous foundries. Link-Belt Co, 307 N. Michigan Ave, Chicago 1, Ill.

● **TRANSFORMERS:** A 40-page reference-type booklet, B-5914, describes the standardization of core form power transformers, Type SL. Construction, materials, operation, quality control, shipping, sound levels, and preserving oil are discussed. Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

● **SAFETY HAT:** A safety hat designed for linemen and electrical construction workers is described in 4-page bulletin, No. 0607-1. Mine Safety Appliances Co, 201 N. Braddock Ave, Pittsburgh 8, Pa.

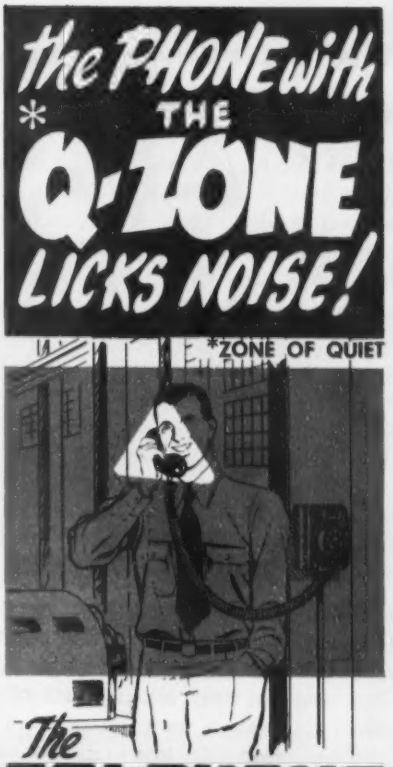
● **COMPRESSORS:** "Bores & Strokes," a 4-page periodical bulletin, features uses of pneumatic and air compressor equipment. Schramm, Inc, West Chester, Pa.

● **FLUORESCENT LAMPS:** A 4-page bulletin, Form 1-166, lists 9 color shades of fluorescent lamps. Lustra Corporation of America, 36 Washington St, Brooklyn 1, N. Y.

● **COMBUSTION CONTROL:** An 8-page booklet gives a case history of air flow-steam flow compensated combustion control as used at Morton Salt Co. Load swings up to 80,000 lb per hr are handled at 35% efficiency. Bulletin R-10. Hays Corp, Michigan City, Ind.

● **FORK TRUCKS:** A variety of electric and diesel fork trucks with capacities from 1,000 to 8,000 pounds are described in a 16-page bulletin. Barret-Cravens Co, 4609 S. Western Blvd, Chicago 9, Ill.

● **DYNAMOMETERS:** Bulletin 154, 4 pages, lists two dynamometers. Model DM-3 measures up to 2 hp; Model MDM, up to 1/10 hp. Mission-Western Engineers, Inc, 132 W. Colorado, Pasadena 1, Calif.



The
GAI-PHONE
ELECTRONIC TELEPHONE

MAKES COMMUNICATION POSSIBLE
IN EXTREMELY NOISY AREAS

Providing dependable telephone service into and from noisy areas *without sound-proof booths,* the GAI-PHONE is operated and connected like a conventional telephone. Designed for dial or manual operation, desk-top or wall mounting, it can be mixed with conventional telephones in the same system. The adjustable transmitter and receiver levels, as well as the adjustable side-tone level, not only assures the greatest operating comfort in noisy areas, but makes the GAI-PHONE very effective over long lines *without repeaters.* Rugged trouble-free design assures long life.

MODEL 200

Designed for wall or column mounting, this model can be used in many noisy locations where a sound-proof booth is not only undesirable but impractical. For example, when equipped with retractile cord (illustrated) and installed on Boiler Control panel, operator's freedom of action and effectiveness are increased greatly.

MODEL 100

Combining all of the GAI-PHONE'S operational features with modern, streamline design makes this model ideal for desk or table top installation.

GAI-TRONICS CORPORATION
READING, PENNA.

A SUBSIDIARY OF GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS

GAI
FOUNDED 1946

FOR FREE BOOKLET
WRITE DEPT. EP

The instrument that put electronics to work

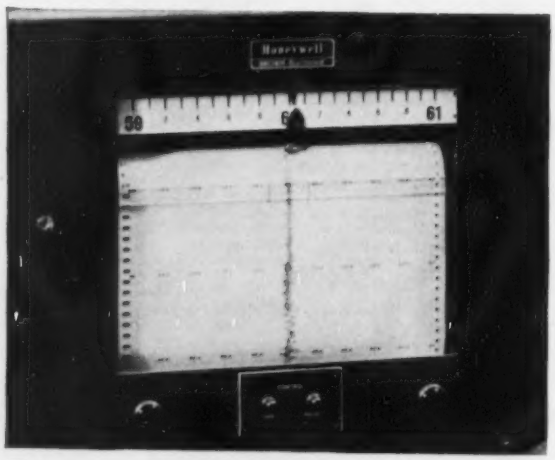
Before electronics came into the picture, industrial instrumentation was caught in a squeeze. On one hand, it was besieged with demands by production men and engineers for higher sensitivity, faster speeds, and greater reliability. And on the other hand, it was hampered by the limitations of mechanical devices. For the instruments of fourteen years ago were merely mechanical imitations of a man watching a galvanometer needle and twiddling dials. They were too delicate . . . too sensitive to vibration . . . too easily led astray by wear or maladjustment. They just couldn't deliver the performance that new production methods required.

In 1940, however, came a major milestone in the progress of instrumentation—development of the *ElectroniK* potentiometer. This was not only a new kind of instrument. It was a new concept of measurement. For the first time, it applied the science of electronics in a practical way to the design of a measuring device for industry. It replaced complicated, fragile mechanical gadgets with a simple but sensitive electronic circuit and servo system . . . the "Continuous Balance" principle of measurement.

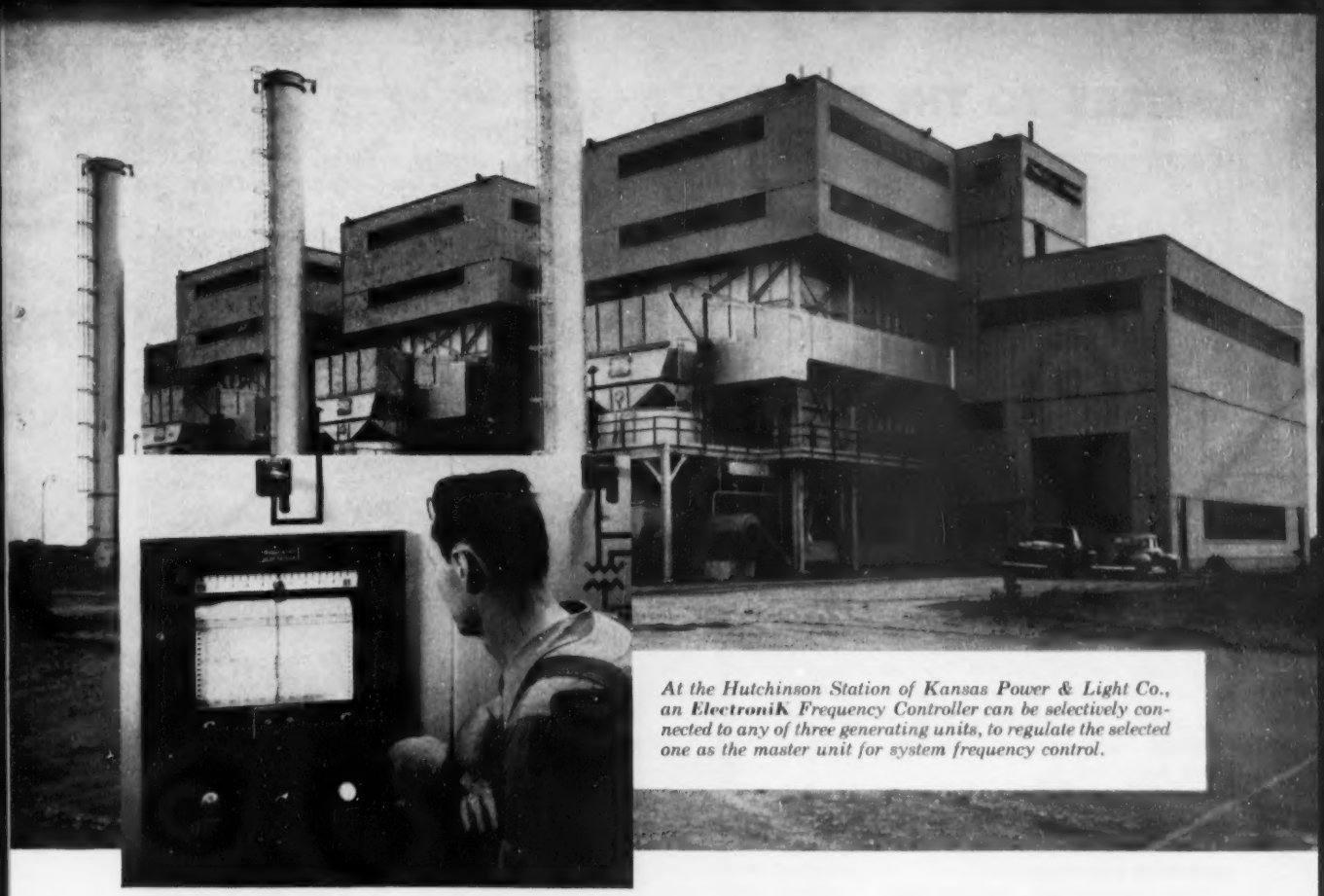
You could tell it was something new when you opened up the *ElectroniK* instrument's case. There was no sign of whirring gears, levers and cams. You could tell it was giving a new kind of performance in measurement, too, by the way the pointer would move swiftly and surely in one smooth sweep whenever the measured variable changed.

The *ElectroniK* instrument gained quick acceptance by production men, engineers, research technicians and maintenance men. They liked the way it provided laboratory accuracy and sensitivity, week after week, under the toughest industrial service conditions. They found that its speed and precision made possible improvements in product quality and process operation that had been unattainable before. And they have proved their confidence by ordering and reordering *ElectroniK* instruments by the thousands . . . not solely because it was *first* of its kind, but because it has continued to be the *best* in performance.

ElectroniK frequency recorder sets new standards



The range from 59 to 61 cycles per second is spread across 10½ inches of calibrated chart.



At the Hutchinson Station of Kansas Power & Light Co., an ElectroniK Frequency Controller can be selectively connected to any of three generating units, to regulate the selected one as the master unit for system frequency control.

for measurement and control

RECORDING and controlling of system frequency reaches a new level of performance when the *ElectroniK* Frequency Recorder goes to work for you. By applying the electronic "*Continuous Balance*" principle, this instrument makes available greater precision, speed and sensitivity than ever before possible.

It's more accurate . . . embodies a pulse frequency-to-millivolt converter in a null-balance precision d-c bridge circuit with an over-all accuracy of ± 0.01 cps.

It's fast . . . high-speed electronic balancing follows every change in frequency. Full scale pen speeds of 12 or 24 seconds are available.

It's sensitive . . . responds to frequency variations as small as 0.005 cps . . . spreads the range from 59 to 61 cycles across 10½ inches of calibrated chart.

As a recorder, the instrument gives operators better data on which to base generation changes . . . is also supplied as a dual purpose instrument to chart both frequency and time deviation. As a controller, it incorporates auxiliaries engineered by Honeywell to regulate turbine governors for flat frequency under fluctuating load conditions.

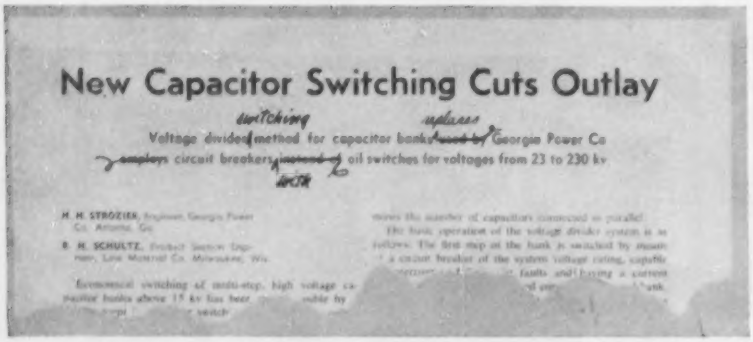
Your nearby Honeywell sales engineer will be glad to discuss applications in your own power plant. Call him today . . . he's as near as your phone.

MINNEAPOLIS - HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

● **REFERENCE DATA: Write for Catalog 90-1, "Supervisory Instruments for Power Generation".**

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

LETTERS TO THE EDITOR



New Capacitor Switching Cuts Outlay

switching replaces

Voltage divided method for capacitor banks used by Georgia Power Co

employs circuit breakers instead of oil switches for voltages from 23 to 230 kv

with

H. H. STROZIER, Engineer, Georgia Power Co., Atlanta, Ga.

B. H. SCHULTZ, Product Section Engineer, Line Material Co., Milwaukee, Wis.

Economical switching of multi-step, high voltage capacitor banks above 15 kv has been made possible by [illegible] switch

moves the number of capacitors connected in parallel.

The basic operation of the voltage divider system is as follows: The first step of the bank is switched by means of a circuit breaker of the system voltage rating, capable of [illegible] faults and having a current [illegible]

Errors—But no Comedy

To the Editor:

I have received the March 22 issue of Electrical World containing the joint article on the Voltage Divided Switching Method. The article looked very good in print. We should soon be receiving many inquiries and comments concerning it.

However, I would like to point out several errors in it. I believe a correction should be made in a following issue of your magazine.

First, the subtitle as published "Voltage Divided Method for Capacitor Banks Used by Georgia Power Company Employs Circuit Breakers Instead of Oil Switches for Voltages from 23 to 230 Kv" is just the reverse of the actual practice and is described in the article. (See illustration)

Second, several errors in figure number reference occurred throughout the article which you have already acknowledged. Under the heading "Basic Operation," the figure reference should have been Figure 1. Under the heading "Isolation Transformers," the figure reference should have been Figure 2. Under the heading "Overvoltages," the figure reference should have been Figure 3. Under the heading "Unbalanced Detection," the figure reference should have been Figure 1.

Third, under the heading "Economical Switching," in the second line of the second paragraph the words "restrikes freely" should have read "restrike-free."

B. H. Schultz
Product Section Engineer
Line Material Co.
Milwaukee, Wis.

Look for Weak Tubes

To the Editor:

Many VHF receivers have been converted over to UHF receivers by the addition of a UHF converter. This is usually an external unit, designed to receive the new UHF frequencies (Channels 14 to 83) and convert them by means of a local oscillator tube such as (6T4) or (6AF4) to an unused channel on the VHF receiver. The output signal of the UHF converter is connected to the input antenna terminals of the UHF receiver; and the conversion of UHF to VHF is completed through the proper VHF channel.

However because of the ultra-high frequencies at which this transposition takes place, the oscillator tube in order to function properly should be operating at peak efficiency; or the owner may encounter snow, poor contrast, or no picture at all on the UHF channels.

If the converter has been in operation for some time (usually over 6 months) a reduction in voltage may cause a sharp cut-off action in the oscillator tube of the converter—thus causing loss of UHF reception, especially on the higher frequencies.

On a recent investigation, a customer using a highly reputable UHF converter and a well-known TV receiver complained that every evening during peak load, his UHF-TV picture disappeared entirely on all five UHF channels. However later in the evening, reception was again normal.

An investigation showed his normal operating voltage to be 120. However, because of inadequate wiring in the home (a single circuit for the entire house) there was a decided reduction in voltage at the TV receiver if other loads were in use at the same time. When the voltage at the TV receiver was reduced to 114 v, the UHF converter oscillator tube (6T4) refused to function; and the TV picture would disappear entirely. However if the voltage was returned to normal, the TV picture reappeared.

The owner then replaced the converter oscillator tube (6T4) with a new one, and the UHF converter operated without loss of UHF-TV picture even when the voltage was reduced far below 114. Thus what may appear to be a justifiable TV voltage complaint may only be a weak UHF oscillator tube in the converter unit of a UHF-TV installation.

Howard J. Ketz
Distribution Engineer
Scranton Electric Co
Scranton, Pa.

The Voice of Authority

To the Editor:

In the March 29 issue the article, "Flatiron Pump-Turbine Gives Big T Water a Lift in the Colorado Rockies," contains two important errors:

1. It states, "It's one of the few major installations of its kind in the country." This unit is the only one of its kind not only in the country but on the North American continent.

2. The parenthetical reference to TVA Hiwassee pump-turbine that it was recently put in and calling it a turbo-generator is incorrect. This Hiwassee unit, which will be the world's largest electric motor and reversible pump-turbine, is still in the process of manufacture and will not be installed until 1955.

Frank E. Jaski
Asst Chief Engineer
Hydraulics Section
Power Dept
Allis-Chalmers Manufacturing Co
Milwaukee 1, Wis.

• Allis-Chalmers has the contract for both Flatiron and Hiwassee units.

Note brush-free condition of sprayed right-of-way through timber-grown area, result of treatment with Dow brush killers.

DOW

DOW BRUSH KILLERS

CUT CLEARANCE COSTS

Esteron Brush Killer and Esteron 245 simplify maintenance of power and communication lines

Dow's low-volatility ester brush killers supply the answers to vegetation problems on right-of-ways, around installations and along roads. Esteron® Brush Killer or Esteron 245 enable your line cleaning crews to get their jobs done at savings from 25% to as high as 50% over hand cutting methods.

Esteron Brush Killer controls most woody plants including 2,4-D resistant species. Both products can be used as a water spray on foliage in growing season or in oil for year-around basal bark treatment. Both are effective for stump treatment in any season.

Where tough weeds and grass are a problem, write for the facts on late developments of Dow research. Our sales and technical men will be glad to help you plan your spraying program. THE DOW CHEMICAL COMPANY, Agricultural Chemical Sales Department, Midland, Michigan. In Canada: Dow Chemical of Canada, Limited, Toronto, Canada.

you can depend on DOW AGRICULTURAL CHEMICALS

DOW

NEWS ABOUT PEOPLE

Whitmore Elected President . . .

. . . of Iowa-Illinois G&E to succeed C. P. Conrad, new company chairman. Kleinman, Tinsman are named vice presidents

CHARLES H. WHITMORE

Charles H. Whitmore, vice president and general counsel of Iowa-Illinois Gas & Electric Co, has been elected president to succeed C. P. Conrad, who was appointed to the newly created position of chairman.

As chairman of the company, Conrad will continue as chief executive officer. As second in command, Whitmore will direct and manage the operation of the utility and all staff services, except finance and accounting.

New VP's . . . The utility also announced the election of two new vice presidents. They are: H. A. Kleinman, former manager of the electric production department who now will be in charge of operations; and R. Hovey Tinsman, who will continue to serve as treasurer.

Other officers appointed include W. M. Huebsch, secretary and assistant treasurer; and G. R. Wissing, assistant secretary. These three were named assistant vice presidents: C. J. Math, G. A. Uhlmeyer, and J. M. Hollingsworth.

The newly elected president has been associated with the company since 1946. First he was assistant to the president, later becoming general counsel. In 1950 he was named vice president and general counsel. Prior to 1946, he was connected with United Light & Railways Co, serving as executive operating assistant.

Iowa-Illinois G&E Veteran . . . Kleinman's affiliation with the company and its predecessors dates back to 1921. Starting as an engineer, he served at the company's Riverside generating station near Davenport, Iowa, the Moline, Ill., generating station, and the Moline gas plant. In 1942 he was assigned to the manager's post.

Tinsman joined Iowa-Illinois as secretary-treasurer in 1942 after extensive experience in banking and investment circles. From 1921 until 1942 he was vice president of Prescott, Wright, Snider & Co, Kansas City bankers.

Active in IUA . . . Conrad was named president of Iowa-Illinois G&E in 1946. Prior to entering the Navy in 1940, he was active in public utility management in Brazil, where he worked with the Brazilian Traction Light & Power Co. He is second vice president of the Iowa Utilities Association (EW, Feb. 22, p 192).

H. A. KLEINMAN

R. H. TINSMAN

EUGENE B. RIPLEY

Connecticut L&P Names Ripley Chief Engineer

Connecticut Light & Power Co has promoted Eugene B. Ripley from mechanical engineer to chief engineer, reporting to Walter W. Forman, engineering and operating vice president. Calvin T. Hughes, vice president, is now vice president and consulting engineer for the company, reporting to President Sherman R. Knapp.

In other promotions, General Engineer Harold M. Kopp was advanced to gas engineer responsible for gas engineering and operations for the entire company. Russell Hicock, transmission and distribution superintendent, was elevated to operating superintendent. Engineer John R. Beccia is now utilization engineer, reporting to Hicock. Both Kopp and Hicock in their new engineering capacities

For a combination of

GOOD CONDUCTIVITY
RESISTANCE TO STICKING
RESISTANCE TO ARC EROSION
IMPACT STRENGTH

ELKONITE® CONTACTS have no equivalent

The secret of Elkonite superiority for heavy duty circuit interrupting equipment is in its physical structure . . . the way in which the desirable properties of each constituent metal are retained to a high degree in the final composite material.

An exclusive Mallory process combines the high melting points of tungsten, molybdenum, or their carbides, with the current-carrying ability of silver and copper in a way that has never been equalled. As a result, no contact material can match Elkonite in all four features that spell top performance . . . conductivity, impact strength, resistance to arc erosion and sticking.

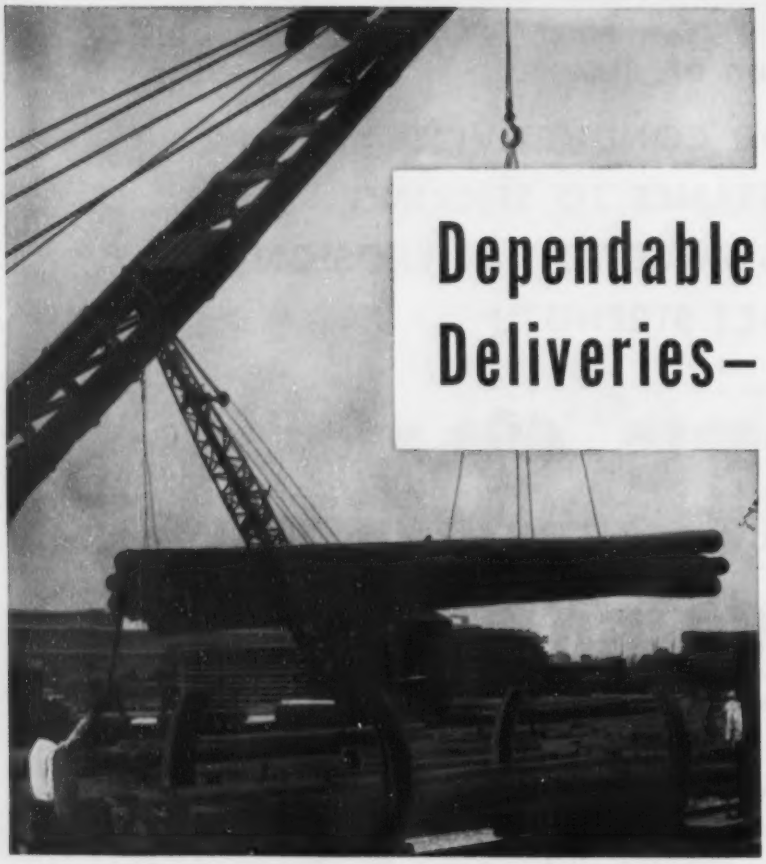
To builders of circuit breakers and switch gear of any rating, Mallory offers a quarter century of specialized contact experience and a complete family of contact materials. Only by specifying Mallory Elkonite can you be sure of Elkonite dependability under all conditions.

➧ Write for your copy of the new Mallory Contact Catalog. It includes a discussion of all Mallory alloys and facilities for producing contacts and contact assemblies for every service.

Expect more...Get more from MALLORY

Serving Industry with These Products:
Electromechanical—Resistors • Switches • Television Tuners • Vibrators
Electrochemical—Capacitors • Rectifiers • Mercury Batteries
Metallurgical—Contacts • Special Metals and Ceramics • Welding Materials

P.R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA



One of our valued customers writes: "We have been buying poles and treated timber from you since about 1930. Your products have been very satisfactory. Also, your service in getting shipments to us has been very prompt."

Koppers Poles go out on schedule!

• Koppers has a "head start" when it comes to pole deliveries. Because Koppers has many wood-treating plants, located in strategic places. And these plants carry ample stocks.

Koppers Poles are *good* poles, too. Pressure-creosoted for their full length, these poles are fully protected against decay, weathering and termite attack. You get long service life from dependable Koppers Poles.

And you can count on *Koppers,* the best known name in pressure-treated wood for quality, service, and experience.

KOPPERS COMPANY, INC.
Wood Preserving Division • Pittsburgh 19, Pennsylvania

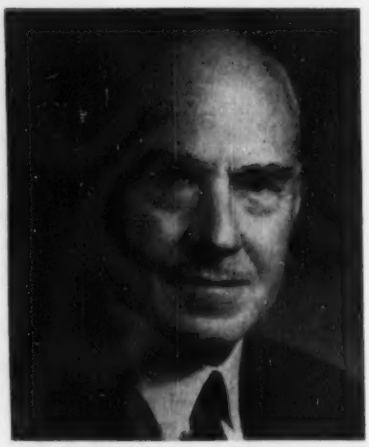
KOPPERS ® PRESSURE-CREOSOTED WOOD

will report to Vice President Forman.

A graduate of Sheffield Scientific School, Yale University, Ripley began his career with Connecticut Light & Power in 1926 as assistant engineer with the general operating department in Waterbury. Assigned as production engineer in 1929, he was made Devon plant superintendent in 1939, and mechanical engineer in 1951.

Hughes, an electrical engineering graduate of the University of Oklahoma, joined CL&P shortly after World War I. He was elected a vice president in 1949.

Kopp started in 1919 with Waterbury Gas Light Co, which was later merged with CL&P. He was named general engineer for CL&P in 1930. Hickock joined the Connecticut utility in 1927, becoming transmission and distribution superintendent in 1951. Beccia began his utility career in 1926 with Waterbury Gas Light, transferring to CL&P in 1931. He was appointed engineer in 1949.



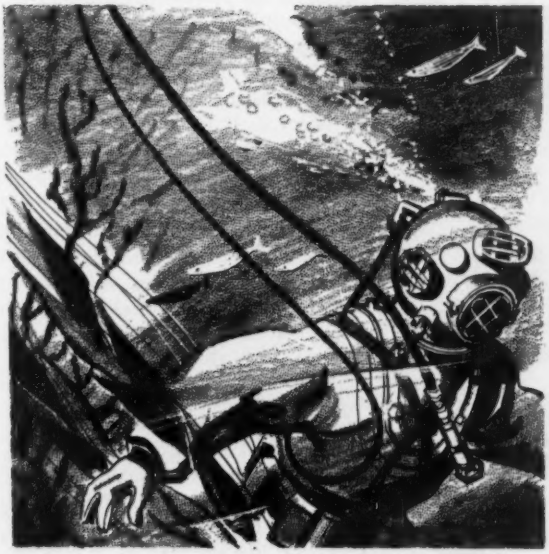
H. B. ABBOTT-SMITH

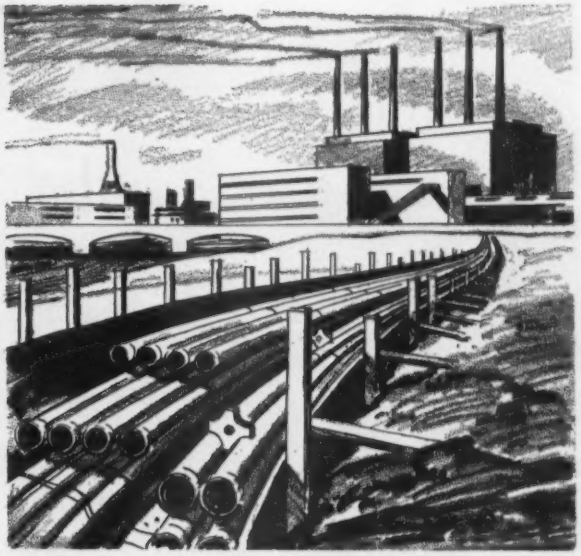
Abbott-Smith Appointed a VP of Shawinigan W&P

H. B. Abbott-Smith, manager of the power sales department of Shawinigan Water & Power Co, Montreal, Que., has been appointed vice president in charge of that department. In addition, N. P. Woods, vice president of finance and treasurer, has been elected to the company's board of directors. They succeed P. S. Gregory, who has retired.

Abbott-Smith, who earned an electrical engineering degree from McGill University in 1923, joined Shawinigan a year later as an operator in the gen-

LIFE LINES





Oxygen lines are the life lines of every diver!
Electric cables are the life lines of every community!
Orangeburg Fibre Conduit gives cables complete underground protection!

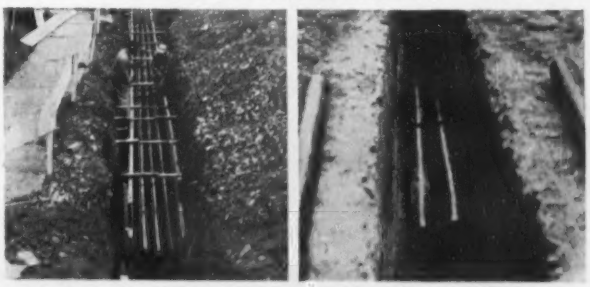
ELECTRICAL CABLES...the *life lines* through which power flows into every community's homes, offices and plants...must have the fullest and the longest protection possible. And that is what they get in the underground ducts with Orangeburg Fibre Conduit.

This is a fact so well understood throughout the electrical industry that Orangeburg Fibre Conduit is a first choice of Public Utilities, Municipalities, Industries and Electrical Contractors everywhere.

The reasons for Orangeburg's High Quality! Tough, strong, resilient, non-metallic...Orangeburg Fibre Conduit does not crack or break. Its impermeable walls and tight joints bar out corrosive ground waters. Its smooth bore and low coefficient of friction protect cable sheaths from abrasion while *going in* and *after they are in* the duct. Orangeburg material resists acids, alkalies, salt, grease, oil. The net result: a *longer-lived* raceway for *longer* cable life.

Check these cost-saving advantages...Light weight ... long lengths ... readily assembled joints ... angle couplings, bends and other Orangeburg standard fittings ... these are some of the reasons why Orangeburg Fibre Conduit is so quick, easy and economical to install. Send to Dept. EW-54 for more facts.

ORANGEBURG MANUFACTURING CO., INC.
ORANGEBURG, NEW YORK
West Coast Plant, Newark, Calif.



ORANGEBURG FIBRE CONDUIT

STANDARD with concrete encasement **NOCRETE** without concrete encasement

---

Graybar ELECTRIC COMPANY
DISTRIBUTORS, ORANGEBURG FIBRE CONDUIT
BRANCHES AND STOCKS IN PRINCIPAL CITIES

GENERAL ELECTRIC SUPPLY COMPANY
A Division of General Electric Distributing Corporation

Snap-on* MASTER
GENERAL SET
½" SQUARE DRIVE

SET 368A-M-B

—covers widest range of wrench operations

By far the widest range of nut turning operations, in both production and maintenance, are covered with this Master Wrench set—½" drive, wrench sizes from ⅜" to 1¼". With this set your men have at their finger tips every combination of handle, adaptor, extension and socket to speed any job in this wrench size. On job after job you get the pay-off of Snap-on's superior speed, flexibility, durability. The sturdy Mechanikit chest has tote-tray and drawers for orderly tool arrangement and safekeeping. Available through your nearby Snap-on branch. For Snap-on industrial catalog and 104-page general catalog of hand and bench tools, write—

SNAP-ON TOOLS CORPORATION
8108-D 28th Avenue, Kenosha, Wisconsin

*Snap-on is the trademark of Snap-on Tools Corporation.

erating station at Shaninigan Falls. In 1925 he was assigned to the meter department, transferring to the Montreal head office in 1928. In 1946 he became superintendent of the records division of the power sales department, and two years later was appointed manager of the department.

With Shawinigan since 1916, Woods was appointed treasurer in 1947, vice president in 1950, and vice president of finance in 1952. Gregory, who received his electrical engineering degree from McGill in 1911, started with Shawinigan in 1918. He was made a vice president in 1941, and director in 1951.

•

David W. Nurse, vice president in charge of manufacturing and **Charles M. Kirkland,** vice president in charge of sales of Okonite Co, Passaic, N. J., have been elected members of the firm's board of directors. **Frederic R. Kirkland,** father of Vice President Kirkland, has resigned as a director after serving in that capacity for 16 years.

Martin D. Bergan, director of research for Thomas & Betts Co, has been named engineering technical director of the Elizabeth, N. J. firm. In another engineering appointment, **L. M. Curtiss,** executive engineer, was made assistant chief engineer in charge of development.

Ralph L. Thomas, vice president and executive engineer and a director of Consolidated Gas Electric Light & Power Co of Baltimore, has retired from those posts. Thomas' retirement ends a 16-year career with the utility, which he served for 15 years as a director and a vice president since 1942. **E. C. Wareheim,** president of Commercial Credit Co, Baltimore, fills Thomas' vacancy on the board.

Chester F. Gilbert, manager of Westinghouse Electric Corp's Retail Finance Division since joining the company in 1945, has been elected vice president and appointed general manager of the newly organized Westinghouse Credit Corp.

Hershner Cross has been made general manager of General Electric Co's distribution assemblies department, Plainville, Conn., which manufactures low voltage power distribution equip-

ment. Prior to his new assignment, Cross was general manager of the GE Trumbull components department.

R. F. Allen has joined H. K. Porter Co, Inc, Pittsburgh, Pa., as assistant to the executive vice president. Allen, who comes to Porter with 24 years of management background, most recently was president of Stansteel Corp.

Carl O. Friend has been named administrative manager for the Heavy Machinery Division of Nordberg Manufacturing Co, Milwaukee. Friend is succeeded as manager of the gasoline marine engine department by **Harrison E. Fellows, Jr,** assistant sales manager of that department since 1952. **H. W. Dow, Jr,** district manager of the firm's Mideastern territory since 1947, was made chief sales technician of the Heavy Machinery Division.

Henry Bowes has been named sales promotion manager and **Edward M. Bland** advertising manager of Philco Corp's Television Division. With Philco since 1936, Bowes has been serving recently as special television representative for the corporation. Bland formerly directed sales training.

OBITUARY

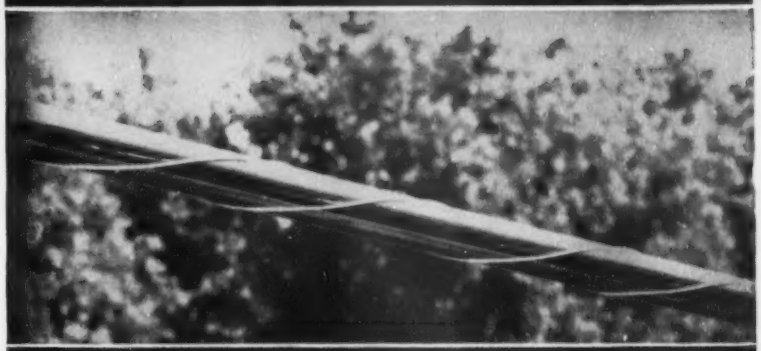
Ernest G. Kellett, secretary and assistant treasurer of Northern States Power Co since 1949, died at Minneapolis April 9. He began working with NSP in 1911 shortly after coming to this country from his native England.

Henry J. Rathgeber, 80, chief engineer at Yale University's Sterling Power Station from 1923 until his retirement in 1950, died April 5 at New Haven, Conn.

Roy W. Smullen, 63, manager of the Philadelphia Electric Co's central and south districts for the past five years, died at Philadelphia April 2. He had been with the company for 45 years, starting as meter tester.

Downing Potter Brown, 67, an officer of Brown Co, Berlin, N. H., and Brown Corp of LaTuque, Canada, died recently in Boston. At the time of his death, he was vice president for administration of Brown Co.

SPIN CABLE LIKE THIS . . .



THROUGH TREE-CONGESTED AREAS AT MUCH LESS COST . . .

You can save man-hours of wood-cutting and customer complaints when you spin cable through tree-congested areas. What is more, spun cable costs much less to install than pre-assembled cable. Spun cable is so compact that it saves valuable space wherever congestion is a problem.

You save splices and installation labor, because light weight single conductor cables may be spun in lengths three times as long as pre-assembled cables.

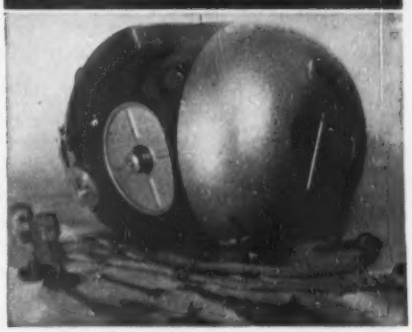
You reduce your cable inventories, because 1/c, 2/c and 3/c cables can be spun in the field as required.

Add to these benefits the extra margin of protection against storm damage . . . and you readily understand why there is a marked trend to cable spinning in the power field.

with NEALE Model "K"

HOW IT WORKS

Drum rotates when its two friction drive wheels respond to pulling of wire. Drum revolves once when 13" of wire is pulled — regardless of condition of strand. Drum carries two spools of wire, each spirals 13" giving support every 6½". Magnesium castings used wherever possible for lightness and strength. Weight: only 36 lbs. Overall length: 18½".



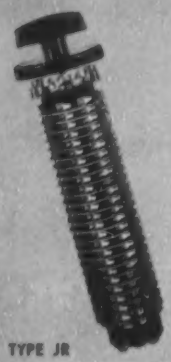
THE WORLD IS SPINNING—TOO! PHONE 2-7234-5

Cable Spinning Equipment Co.

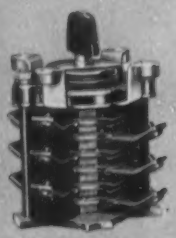
3100 TOPEKA AVE. TOPEKA, KANSAS

ROTARY SWITCHES

For every control, tap, and transfer application.



TYPE JR



TYPE P, 30A

TYPE A

TANDEM TYPE P, 30-10A

TYPE HF

- Save valuable panel space
- Simplify control of complex circuits
- Give "dead-front" mounting safety
- Listed by Underwriters Labs, Inc.
- Can be furnished to latest Navy specs.
- Ratings from 2 amperes to 200 amperes, 30 to 250 volts d. c., and 125 to 500 volts a. c. — depending on number of circuits and nature of load.

Write for combined catalog giving useful design data on Esco rotary switches.

ELECTRO SWITCH
CORPORATION
167 King Avenue, Weymouth 88, Mass.

Lead Errors

(*Continued from page* 113)

angle between them (positive for current lagging voltage).

The true energy recorded by the test meter alone is

$$W_t = V_t I_h \cos \theta_t$$

The actual registration of the meter is

$$R_a = \frac{KN}{W_t} = \frac{KN}{V_t I_h \cos \theta_t}$$

From these equations

$$R_a = \frac{R_m V_a \cos \theta_a}{V_t \cos \theta_t}$$

Vector Relationships . . . Fig 2 shows the vector relationships between these values. In Fig 2 the current, I_m, in the potential circuit of the test meter lags 90 deg behind the voltage, V_t, because the impedance of the potential circuit is essentially an inductive reactance. R_l is the lead resistance (very small compared with this reactance).

Then, from the vector diagram,

$$V_t = V_a \cos \alpha \text{ and}$$

$$\cos \theta_t = \cos (\theta_a + \alpha)$$

$$= \cos \theta_a \cos \alpha - \sin \theta_a \sin \alpha$$

As α is a very small angle, the approximation $\cos \alpha = 1$ may be assumed and $\tan \alpha = \sin \alpha = \alpha$ (in radians). Thus,

$$V_t \cos \theta_t = V_a \cos \theta_a (1 - \alpha \tan \theta_a)$$

and $$R_a = \frac{R_m}{1 - \alpha \tan \theta_a}$$

$$= R_m (1 + \alpha \tan \theta_a)$$

to a sufficiently close approximation for any practical test condition.

From Fig 2,

$$\tan \alpha = \alpha = \frac{I_m R_l}{V_t} = \frac{R_l}{X}$$

where X is the reactance of the potential circuit of the test meter. Thus

$$R_a = R_m \left(1 + \frac{R_l}{X} \tan \theta_a\right)$$

$$= R_m + \frac{R_l}{X} \tan \theta_a$$

since R_m is close to unity.

Therefore, the number $(R_l \div X)$ tan θ_a must be added to the registration as measured to correct for the effect of lead resistance unless the test meter is always used with the same leads.

R_l can be measured with a Wheatstone bridge. X can be computed from Ohms law $X = V \div I$ where I is the current in the potential circuit (measured with an ammeter in series with the potential circuit) when the applied voltage is V.

The angle θ_a is, of course, the phase angle at which the test is made and is positive when the current lags be-

hind the voltage. X must be computed for each voltage range of a multirange meter and the correction applied accordingly. In watthour meters having dual voltage ranges in which two potential coils are connected either in series or parallel, it will be found that the correction is four times greater for the lower voltage range than for the higher voltage range.

Magnitude of Error . . . Some knowledge of the magnitude of the error may be obtained by considering a circuit for testing three portable rotating standards simultaneously.

It is assumed that the potential circuit of each meter has an impedance of 500 ohms. When these circuits are connected in parallel by short heavy leads and the combination attached to the voltage supply and wattmeter potential terminals through a relay circuit with a total "lead resistance" of 0.20 ohms, the error attributable to the lead resistance is —0.0021 at 0.5 power factor, current lagging. Then a correction of +0.21% should be added to the measured registration.

The error would increase and, in fact, might become quite large in different circumstances. Leads of greater resistance, more meters simultaneously under test, or a lower power factor would enlarge the error.

When a meter of known registration is to be used as a standard for testing other meters, care must be taken to insure that a correction for leads is properly applied to both the standard watthour meter and the meter under test. When accurate measurements are sought, lead resistance as a source of error should not be overlooked. When the error is significant, a correction should be applied to the results; or the error itself should be reduced to a negligible value by rewiring the circuit. As meter testing arrangements differ in numerous ways, each testing circuit should at some time be analyzed for possible lead errors.

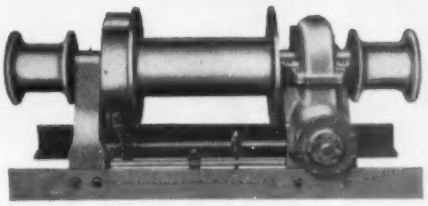
Voltage Regulator

(*Continued from page* 125)

lator. Voltage profiles in Fig 5 show the percentage of total length of line corrected by three types of regulators.

Correct Location . . . In applying voltage regulators along a

TULSA* WINCHES



The Model 23 Tulsa Winch is installed on the truck below. There are 27 other models in capacities from 6,500 to 80,000 lbs. for all makes and models of trucks and crawler tractors.

FOR HAULING...

Loading and unloading 3-ton cable reels is a simple task for this California trucking contractor. Working for a West Coast public utility, the driver easily, quickly and safely handles these reels of expensive copper cable. His Model 23 Tulsa Winch does the entire job.

Tulsa* Winch
TULSA, OKLAHOMA
DIVISION OF VICKERS Inc.

*Reg. U. S. Pat. Off.

HAS YOUR LIGHTING KEPT PACE WITH PROGRESS?

You're always ahead with Sylvania Fluorescent Lamps because of Improved Cathodes

Sylvania's leadership in fluorescent lighting has led to many outstanding advances, including the development, through research, of improved cathode coils and coil coatings, resulting in greatly increased lamp life. All Sylvania Fluorescent Lamps . . . preheat and instant start . . . have exceptionally long life.

In addition, Sylvania offers an assurance of complete satisfaction, or your money back.* So, for "Fluorescent at its finest," insist on Sylvania!

LIGHT FOR FREEDOM · POWER FOR PROGRESS

* Try 24 Sylvania Fluorescent Lamps of any popular type. If, in your opinion they don't give more light and maintain color and brightness for a longer time than any other brand, send them back with your signed Certificate of Assurance and your money will be refunded.

SYLVANIA

Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.

In Canada: Sylvania Electric (Canada) Ltd., University Tower Bldg., St. Catherine St., Montreal, P. Q.

LIGHTING · RADIO · ELECTRONICS · TELEVISION

distribution line their correct location must be determined. Voltage drop from substation to line regulator, given as a percentage of total drop along line at any time, may be expressed as follows:

$$\text{Voltage Drop (Sub to Line Reg in \% of Total)} = \frac{8}{8 + \text{Correction Capability.}} \times 100$$

Correction capability, in formula above, equals voltage spread of line minus band width of line regulator. The constant 8 is allowable voltage drop along the line.

Table IV gives the location of line regulators, the voltage drop from substation to line regulator being expressed as a percentage of the total drop along the line at any time.

The voltage drop from substation to line regulator may be assumed to equal 50% of the total drop along the line. The regulator installation in Fig. 4 shows the regulator located at the "half voltage drop point" of the line.

Half Voltage Drop Point . . . To determine "half voltage drop point" obtain a voltage profile of the distribution line. Voltage profiles are obtained by taking voltage recordings at substation, at two locations along line, and at line's end. The four voltage levels at a specified time are plotted.

The locations in Table IV are exact. To use Table IV, plot a voltage profile of the line. The accuracy of results obtained by using Table IV depends upon the acuracy observed in obtaining a voltage profile, a relatively difficult undertaking. It is preferable to express distance from substation to line regulator as a fraction of total distance from substation to end of the line.

Shape of Profile . . . The correct location of a line regulator depends upon the shape of voltage profile. For a line with a concentrated load at its end voltage profile is a straight line, and regulator should be located halfway between substation and end of line.

The voltage profiles in Fig 6 show the variations which can be expected due to loading of the line, and conductor size, or phasing along the line. Note that correct locations of regulators (distance from substation to regulators being expressed in fractions of the total line length) vary from ¼ to 1/3 of the distance.

Fig 6 may be used as a guide in lo-

cating line regulators. The distance from substation to line regulator should be approximately 30% of the total distance of the line. This "rule of thumb" involves no expense, although it could result in loss of 10% of the capability of the regulator.

Long Taps . . . When determining the location of line regulators, each single-phase line should be considered independently of other lines. In some cases long taps off a single-phase line require special consideration. When the regulator on the main single-phase line is beyond a long tap, it may be necessary to install an additional regulator on the tap line. Moving the main line regulator to include correction for a long tap is a critical procedure. Regulator of main line should not be moved when its displacement seriously reduces capability of the regulator to correct voltage on main line.

In place of multi-step regulators to correct excessive voltage drop, single-step regulators or line voltage boosters may be employed. The size of step should be approximately equal to half the design voltage drop of the line.

The installation of one single-step regulator permits load growth until a peak load equal to 150% of design value is reached. The application of one single-step regulator requires a minimum of analysis. Location of one single-step regulator along a distribution line is not critical. Distance from substation to regulator should be about 35% of total length of line.

Cascaded Regulators . . . Two single-step regulators may be cascaded on the same distribution line although this practice is not often recommended. To obtain maximum voltage correction from two single-step regulators cascaded on a line the regulators must be correctly located. A voltage profile of line is required to determine exact location. This adds to installation cost.

Curve A in Fig 7 is the voltage profile of a line having a maximum drop of 12.5 v. Curve B in Fig 7 is the corrected voltage profile.

Regulators do not function correctly when the flow of power is reversed. During emergency operation, the flow of power on a section of distribution line may be reversed. When a regulator is on that portion of line, the source and load connections should be reversed; or the regulator should be placed in neutral and set for non-automatic operation.

Put "*Wasted Space*" to work

with

REEL-O-MATIC

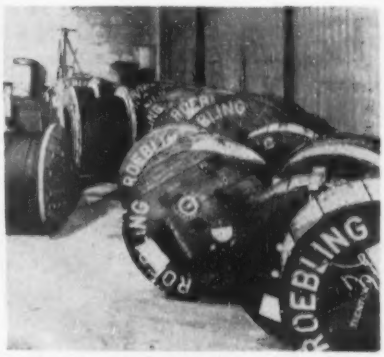
REG TRADE MARK

WAREHOUSE STORAGE RACKS!

Take a good look around *your* warehouse! If you are storing reels of cable or similar bulky products just on the floor, that "empty" space costs you money!

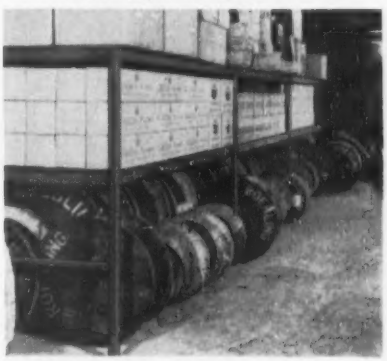
REEL-O-MATIC Warehouse Storage Racks puts that space to work for you . . . make every cubic foot between floor and ceiling pay its way by adding *usable* storage space . . . reducing the need for so much valuable floor space.

Although originally designed to make use of the wasted space above reels, sturdy REEL-O-MATIC Storage Racks have provided the answer to many another tough warehousing problem. REEL-O-MATIC maintains a special division which engineers and builds storage racks for almost every conceivable warehouse need.



BEFORE the installation of Reel-O-Matic Warehouse Storage Racks note the wasted space over the reels!

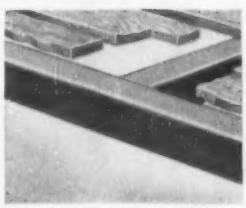
AFTER—Reels stored neatly under racks . . . former "dead" space overhead now pays its way!



STANDARD UNITS AVAILABLE FROM STOCK

1-844—8′ long, 4′ wide, 4′ high, single deck
1-842—8′ long, 4′ wide, 29½″ legs. (Used as top deck for No. 1-844)
84—8′ long, 4′ wide. (Used as lower shelf for No. 844)

SPECIFICATIONS



Shown at right is heavy 3″ steel channel "backbone" of REEL-O-MATIC Warehouse Storage Rack, which runs entire length of decks securely welded to center of steel cross member at both ends. DECKING—First grade 1″ x 4″ yellow pine, attached securely to channel cross members with self-locking fasteners. DECK CAPACITIES*—5,400 lbs. with horizontal members of 4 lb. steel channel. 6,000 lbs. with horizontal members of 5 lb. steel channel. 2,400 lbs. with horizontal members of 2″ steel channel. *Based on 8′ long tables. VERTICAL MEMBERS—2″ x 2″ x 3/16″ or 2″ x 2″ x 1/4″ angle. STANDARD FINISH—Olive Green.

Write for Catalog describing the complete standard line, or outline your needs. We'll be glad to engineer and quote on a "tailor-made" rack to meet your exact warehousing requirements!

REEL-O-MATIC CORPORATION OF AMERICA
COLUMBIA 2, PENNA.

European Makers See Good '54

Producers of heavy power station equipment to have favorable year despite some declines, OEEC report finds

PARIS (McGraw-Hill World News)—European producers of heavy equipment for power stations, who have enjoyed a flush market since the war, see 1954 as a reasonably good year. There will be some declines from the levels reached in 1953, but they will be offset by higher deliveries of other items, particularly very large equipment. These conclusions were drawn from a report just issued by the Organization for European Economic Cooperation (OEEC), an eighteen-nation body which keeps a continuous check on the state of Europe's economic health.

Orders on the books (as of Oct. 1, 1953) for delivery during the year ended March 31, 1955, indicate that the industry as a whole will at least maintain its present level of activity for the next year. After that the order books begin to thin out somewhat, according to the OEEC survey. Orders in hand on Oct. 1, 1953, will keep builders of steam turbines and boilers reasonably busy through 1956-57, but manufacturers of hydraulic turbines and alternators and producers of transformers had 1956-57 forward orders as of last October for less than 25% of their 1953 output.

Except for boilers, a considerable share of reduced forward orders can be laid to slower export demand. Producers are hoping, however, that better delivery dates offered by many suppliers have only changed the contracting habits of overseas buyers and believe new orders will be forthcoming to improve the outlook for the period after March, 1955.

Table I below indicates (with years ended March 31) the main findings of the OEEC survey.

Almost every producing country had shortened delivery periods when the study was made last October, but OEEC did not attempt to calculate the effect of this on forward ordering. Table II below shows the delivery estimates in the principal producing countries for orders placed in October, 1953.

Table I—Plant Equipment Delivery Estimates, Orders

	Deliveries during 1954 (estimated)	Orders Booked Oct. 1, 1953, for delivery: 1955	1956	1957
Steam Turbines (Mw)	5,377	6,842	3,530	2,170
Alternators for Steam Turbines (Mw)	6,249	6,567	4,641	2,170
Boilers ('000 ton/hours)	30,598	29,603	20,249	11,466
Hydraulic Turbines (Mw)	4,951	4,200	2,716	1,240
Alternators for Hydraulic Turbines (Mw)	4,453	3,571	2,599	998
Transformers (Mva)	41,659	33,304	15,428	6,944

Table II—Delivery Periods at Oct. 1, 1953

(Months)

	Germany	Belgium	France	Italy	Switz.	Gr. Britain
Steam Turbines						
Under 40,000 kw	14–22	20	18–24	10–15	16 & up	18–36
Over 40,000 kw	18–24	24	22–28	15–20	22 & up	30–36
Alternators for Steam Turbines						
Under 40,000 kw	16–22	15	15–24	10–20	16 & up	18–36
Over 40,000 kw	20–26	18	24	15–24	22 & up	30–36
Boilers (over 180 t/h)	16–28	24	24–40	18–24	20 & up	26 & up
Hydraulic Turbines	15–22	20	12–26	6–15	14 & up	21–42
Transformers (over 5,000 kva)	5–18	14	10–18	6–18	18 & up	12–36

Iowa P&L to Get A-C's New Exciter System

The first of Allis-Chalmers Manufacturing Co's new exciter systems will soon be installed on a 43,750-kva, 3,600-rpm generator at Iowa Power & Light Co. This was first announced by A-C's H. W. Cory and W. L. Ringland in a technical paper presented before the Missouri Valley Electric Association on April 7.

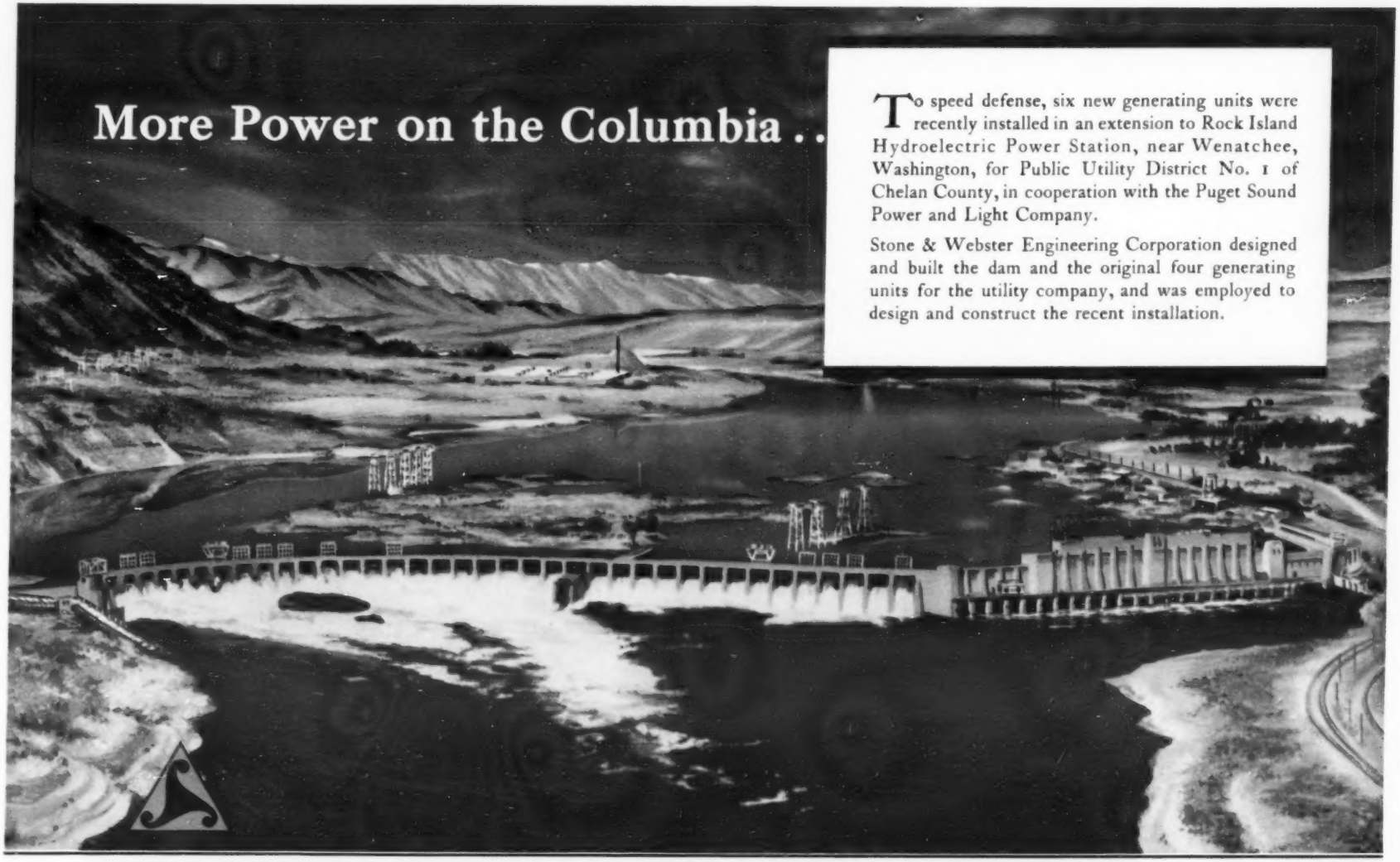
In describing the new system, they said an inductor alternator mounted on the main generator shaft generates excitation power at 360 cps. Its output is rectified by selenium rectifiers to supply the main generator field and a series field in the inductor alternator.

Control of the inductor alternator is by means of a variable-reactance load (magnetic amplifiers) connected to its output terminals. This load is in turn controlled by magnetic preamplifier regulated by comparator circuit from main generator terminals.

The exciter, according to Cory and Ringland, has high reactance and is especially sensitive to lagging-power-factor loads. Because it has effectively no time constant, response speed is governed mainly by the short time constant of the magnetic amplifiers.

Metal Prices

Copper is being uniformly quoted at 30¢ a lb for May delivery as well as for April. Price of lead was increased ¼¢ a lb to 14¢, New York basis. Tin advanced 4¾¢ a lb to $1.01¾, new high for the year. Low was 84½¢ in January. Prices for brass and bronze ingots were advanced by ½¢ to 2¼¢ a lb.


More Power on the Columbia . .
To speed defense, six new generating units were recently installed in an extension to Rock Island Hydroelectric Power Station, near Wenatchee, Washington, for Public Utility District No. 1 of Chelan County, in cooperation with the Puget Sound Power and Light Company.
Stone & Webster Engineering Corporation designed and built the dam and the original four generating units for the utility company, and was employed to design and construct the recent installation.

Write or call us for information as to how our experience may be of assistance to you.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY *of* STONE & WEBSTER, INC.

New York Boston Chicago Pittsburgh Houston San Francisco Los Angeles Toronto

New Chevrolet Trucks

deliver hour-saving power that saves you money, too!

New Chevrolet trucks bring you great new engine power in every model—from light-duty pickups to heavy-duty tractors. And this new power means important savings of both time and money on the job!

YOU SAVE TIME WITH GREATER SAFETY

That's because new Chevrolet trucks permit you to maintain faster schedules *without* driving at higher maximum road speeds. Thanks to greatly increased acceleration and hill-climbing ability, you can save time where it counts. Instead of trying to make up for lost time, you actually cut down the time lost at traffic lights and on steep grades.

YOU SAVE PLENTY ON OPERATING COSTS

New Chevrolet trucks bring you high-compression power that saves you money every mile. All three great engines—the "Thriftmaster 235," the "Loadmaster 235" and the "Jobmaster 261"* deliver greater horsepower *plus* increased operating economy. In addition, the mighty "Jobmaster 261" engine reduces the need for operating in low gears on heavy-duty jobs. As a result, you shift gears less . . . save more on gas.

Now's a good time to see your Chevrolet dealer about a time-saving, money-saving truck. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

CHEVROLET

MOST TRUSTWORTHY TRUCKS ON ANY JOB!

CHEVROLET ADVANCE-DESIGN TRUCK FEATURES

THREE GREAT ENGINES—The new "Jobmaster 261" engine* for extra heavy hauling. The "Thriftmaster 235" or "Loadmaster 235" for light-, medium- and heavy-duty hauling. **NEW TRUCK HYDRA-MATIC TRANSMISSION***—offered on ½-, ¾- and 1-ton models. Heavy-Duty **SYNCHRO-MESH TRANSMISSION**—for fast, smooth shifting. **DIAPHRAGM SPRING CLUTCH**—improved-action engagement. **HYPOID REAR AXLE**—for longer life on all models. **TORQUE-ACTION BRAKES**—on all wheels on light- and medium-duty models. **TWIN-ACTION REAR WHEEL BRAKES**—on heavy-duty models. **DUAL-SHOE PARKING BRAKE**—greater holding ability on heavy-duty models. **NEW RIDE CONTROL SEAT***—eliminates backrubbing. **NEW, LARGER UNIT-DESIGNED PICKUP AND PLATFORM STAKE BODIES**—give increased load space. **COMFORTMASTER CAB**—offers greater comfort, convenience and safety. **PANORAMIC WINDSHIELD**—for increased driver vision. **WIDE-BASE WHEELS**—for increased tire mileage. **BALL-GEAR STEERING**—easier, safer handling. **ADVANCE-DESIGN STYLING**—rugged, handsome appearance.

**Optional at extra cost. Ride Control Seat is available on all cab models, "Jobmaster 261" engine on 2-ton models, truck Hydra-Matic transmission on ½-, ¾- and 1-ton models.*

RECORD ATTENDANCE of 1,200 stockholders heard Gwilym A. Price (at podium), president of Westinghouse Electric Corp, address 68th annual stockholders meeting held this month under the 'big top' at the company's Sunnyvale, Calif., plant. President Price flew out from Pittsburgh with company officers and 13 of the 20 directors. A buffet luncheon and a stockholder tour of the Sunnyvale plant's manufacturing facilities followed the business meeting

Westinghouse Parley Held in 'Big Top'

Biggest show yet as far as Westinghouse Electric Corp annual stockholders meetings go was held early this month—appropriately—in a specially pitched "big top" at the company's Sunnyvale, Calif., plant.

The 68th annual meeting was the first in the West for Westinghouse and the California hosts, true to the state's reputation for "biggests," claimed the record attendance—1,200 stockholders—as another California accomplishment. Stockholders attending the meeting came from 15 states and more than 100 cities in all sections of the country.

Master of Ceremonies Gwilym A. Price, president of Westinghouse, opened the show by introducing to the group of company owners the 13 directors who were present—out of 20—and a number of vice presidents.

Sales Up 11% . . . He then reported that sales for the first two months of 1954 were 11% above the corresponding period last year, and that earnings also were substantially higher than those for the like 1953 period.

Feature event was the announcement that Westinghouse has signed an agreement to purchase television station KPIX in San Francisco. The proposed purchase is "part of the Westinghouse plan to acquire and operate television stations in key centers of the country," Price said. Completion of the purchase will depend on federal agencies' approval and on tax legislation affecting this type of transaction now under consideration in Congress.

Noting the current decline in business activity, Price said that "a moderate decrease from the peak level was not unexpected." But he doubted that the country is heading for a depression. He preferred to view the current situation as a "transition in the upward march of our economy; a temporary decline while we prepare for the next ascent to a higher level of economic activity."

Audience participated in question periods that stretched overtime.

2 Eastern Firms Awarded Pilot Knob Plant Orders

Two equipment contracts for the Pilot Knob hydroelectric plant, on the American Canal 20 miles downstream from Imperial (Calif.) Dam, have been awarded by the Imperial (Calif.) Irrigation District.

Elliott Co, Jeannette, Pa., won a $1,121,486 contract for installation of two generators and accessories—the largest equipment contract ever let by the district. A $948,180 contract for hydraulic turbines and governors for the plant went to Baldwin-Lima-Hamilton Corp, Philadelphia.

The $10 million Pilot Knob plant will generate 33,000 kw.

Kearney's Arkansas Plant Manufactures Fuse Links

James R. Kearney Corp, St. Louis, Mo., will start manufacturing fuse links for distribution cutouts this month at its new Fayetteville, Ark., factory.

First unit to be completed in the Kearney program for multi-plant operation, the factory is reported to be the only one in the industry specifically designed and equipped to make fuse links. It also has facilities for warehousing other equipment to serve customers in the South Central and Southwest United States.

Vernon Hellstern, a member of the Kearney engineering department for 13 years, is plant manager.

The St. Louis firm also announced that new warehouses were opened at Chicago, Des Moines, Indianapolis, Minneapolis, and Lexington, Ky.

(*Continued on page* 225)

MANUFACTURERS' EARNINGS

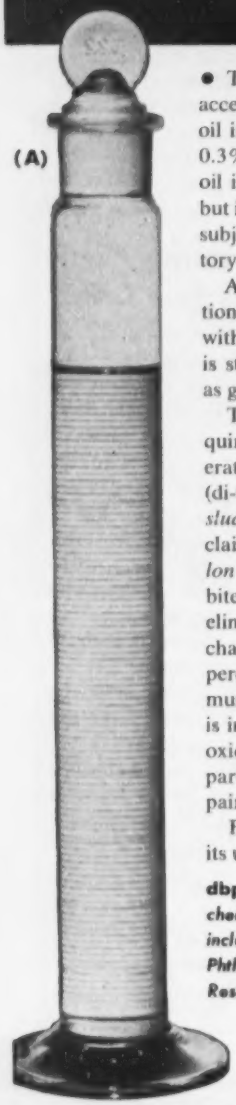
Company	Period Months Ended		Net Income 1954	Net Income 1953	Earnings Per Common Share 1954	Earnings Per Common Share 1953
Avco Manufacturing	3	Feb.	$1,612,199	$2,860,241	$ .17	$ .31
Babcock & Wilcox	2	Feb.	2,027,000	2,154,000	1.30	1.38
Kaiser Aluminum & Chemical	3	Feb.	109,979	1,235,542	.16(a)	.28
			1953	**1952**	**1953**	**1952**
Continental-Diamond Fibre	12	Dec.	826,673	798,814	1.84	1.78(b)
Colt's Manufacturing	12	Dec.	703,770	677,527	1.76	1.69(b)
Copperweld Steel	12	Dec.	2,852,078	2,304,387(c)	5.05	4.38
Dixon, (Jos.) Crucible	12	Dec.	222,965	110,510	4.46	2.21
Dravo	12	Dec.	4,365,900	3,106,314	8.63	6.07
Federal Electric Products	6	Dec.	572,330	.....	1.04	.....
H. K. Porter	12	Dec.	2,634,519	1,522,664	.....	.....
Thor Power Tool	12	Dec.	1,620,841	1,608,002	2.16	2.14

Notes—(a) On Preferred stock; (b) Based on shares now outstanding; (c) After giving effect to $354,594 tax credit

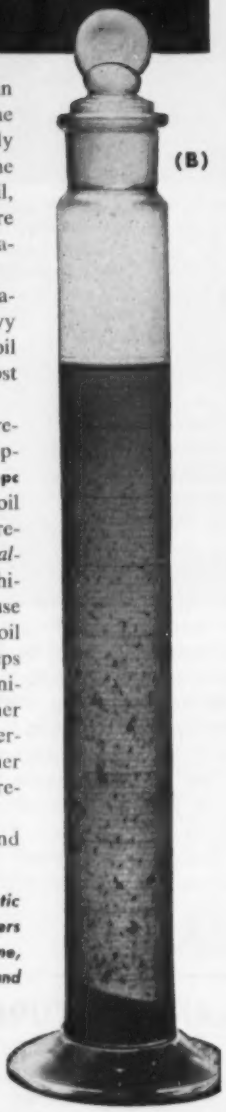
Accelerated Oxidation Tests Prove—

dbpc®-inhibited oil stays sludge-free

(A)



(B)



• These vials show the results of an accelerated test on transformer oil. The oil in vial "A" was inhibited with only 0.3% by weight **dbpc** antioxidant. The oil in vial "B" is the same type of oil, but is uninhibited. Both vials of oil were subjected to the same number of laboratory-simulated "years of oxidation."

After 50 days of accelerated oxidation tests, the uninhibited oil is heavy with sludge, while the **dbpc**-inhibited oil is still completely sludge-free—almost as good as new.

Today's high-load transformers require a sludge-free insulating oil to operate efficiently and economically. **dbpc** (di-tert-butyl-para-cresol) keeps this oil *sludge-free*, whether it be new or reclaimed *for as little as two-cents per gallon material cost!* And because inhibited oil lasts so much longer, its use eliminates the expense of frequent oil changes. Moreover, since **dbpc** keeps peroxide and acid formation to a minimum, the service life of the transformer is increased. Without an inhibitor, peroxides and acids attack the transformer parts necessitating frequent costly repairs.

For further information on **dbpc** and its uses write to Koppers today.

***dbpc** is only one of the many synthetic chemicals produced by Koppers. Others include Styrene Monomer, Polystyrene, Phthalic Anhydride, Divinylbenzene and Resorcinol.*

KOPPERS COMPANY, INC.

Chemical Division, Dept. EW-4194, Pittsburgh 19, Pennsylvania

KOPPERS ®

Koppers Chemicals

SALES OFFICES: NEW YORK · BOSTON · PHILADELPHIA
ATLANTA · CHICAGO · DETROIT · LOS ANGELES

BOOKS

Received Since March 15

Elements of Electrical Machine Design. By Alfred Still and Charles S. Siskind. Published by McGraw-Hill Book Co, Inc, New York 36, 445 pages, illustrated. Price $9.00.

Aluminum Conductors

Aluminum-freileitungen. Published by Aluminum Verlags, Dusseldorf, Germany. 212 pages, illustrated. Price 19.20 marks.

This is a seventh printing of a treatise on aluminum overhead conductors sponsored by the German manufacturers of the wires and the requisite fittings. Properties and tests are followed by the methods of installing and connecting, of tying to the insulator or transmission clamp. Control of vibration is also discussed. The final quarter is devoted to appended tabular and graphic data.

Basic Electronics

Applied Electronics—2nd edition. By Truman S. Gray. Published by Technology Press M.I.T. and John Wiley & Sons, Inc, New York 16. 905 pages, illustrated. Price $9.00

This revision of Gray's 1943 book is designed as a first course in electronics, electron tubes, and associated circuits. Coverage includes basic physical phenomena; combinations of phenomena that govern characteristics, ratings, and limitations of devices; applications common to the several branches of electrical engineering; and treatment of semi-conductor rectifiers and transistors.

Emphasis is not on advanced mathematics, but rather on clarity and reasoning. Attention is given minor details so easily spanned by experienced engineers, but so disturbing to inexperienced students. Appendices include constants, conversion factors, problem answers, bibliography, and author and subject indices.

This book is useful to the power engineer who needs an electronics background, or for reference.

Tables Aid Transmission Designers

Numerical Tables and A Manual on Catenary Calculations. By J. W. Campbell, 11138 - 87 Ave, Edmonton, Can. Price, each $1.

The tables cover log X, X^n, X^2, 1/X, sines, tangents (and their logs), log, X, e^x, cosh X and sinh X, in general to 4 places. In conjunction with the catenary manual the Calgary Power Co has long designed their transmission spans and pre-computed the stringing conditions. The manual gives the requisite formulas and shows how to tabulate systematically the values taken from the numerical tables in arriving at sags, tensions, clearances, and other information essential to transmission line design.

talk about PUNISHMENT!

Southern States Cutouts take it time and time again . . . in the laboratory and in the field to prove their Absolute dependability.

The modern Southern States cutout, like the type H-33-D shown here, is a rugged device capable of withstanding terrific electrical and mechanical stresses repeatedly. Like all Southern States cutouts it has been tested on thousands of installations and has been subjected to a multitude of laboratory tests.

The present rugged form and dependability of performance of these cutouts is the result of this long experience. Positive latching, full dropout action, high pressure line contacts and self locking hinges are a few of the outstanding design features that have evolved and are now common to all Southern States cutouts.

For complete information write for Bulletin 530 C.

Southern States
HAMPTON

SS

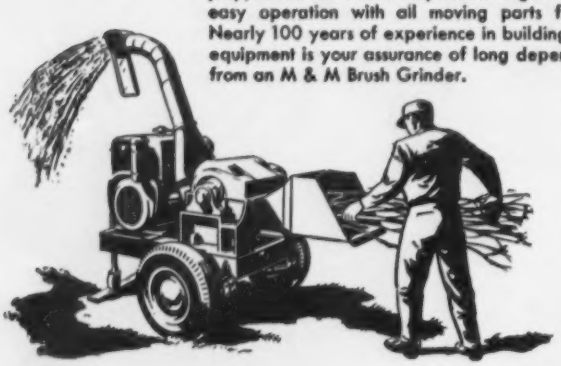
Equipment Corp.
GEORGIA

SAVE up to 85% brush handling costs

This new M&M Brush Grinder rapidly converts 7 truckloads of brush into one truckload of chips.

Save on labor costs . . . truck operating costs. One man feeds brush or branches up to 6" in diameter into the Brush Grinder where they are chewed into small uniform wood chips and automatically blown into a truck or spread on the ground. The new M & M Brush Grinder is a portable unit with its own power plant. It hitches to jeep, car or truck for transportation right to the job. Safe easy operation with all moving parts fully enclosed. Nearly 100 years of experience in building fine grinding equipment is your assurance of long dependable service from an M & M Brush Grinder.

81



WRITE FOR ILLUSTRATED FOLDER TODAY

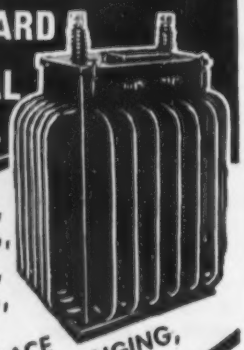
MITTS & MERRILL 1002 S. WATER ST., SAGINAW, MICHIGAN

EISLER

TRANSFORMERS

STANDARD • SPECIAL

AIR • OIL • WATER-COOLED



POWER, LIGHTING, HEATING, WELDING, ELECTRIC FURNACE PHASE CHANGING, ETC.

EISLER Transformers are built strictly to N. E. M. A., A. S. A. and A. I. E. E. standards.

SEND FOR NEW CATALOG NO. TR-50

¼ TO 500 KVA • UP TO 15,000 V.

CHAS. EISLER

EISLER ENGINEERING CO., Inc.

769 SOUTH 13th ST NEWARK 3 N J U S A

If . . .

YOU CHANGE YOUR ADDRESS

Be sure to notify us so that future copies of ELECTRICAL WORLD will be delivered promptly.

Also make certain you advise your local Postmaster so other important mail doesn't go astray. Both the Post Office and we will thank you for your thoughtfulness.

Send your new and old address to:

Subscription Dept.

ELECTRICAL WORLD

330 W. 42nd St.

New York 36, N. Y.

Employees Stock Plan

(*Continued from page* 130)

Willis Gale, Edison chairman, said that no details have as yet been worked out but that any plan adopted will not be a "stock sales plan."

"It will be a stock purchase plan," he said, "which an employee may join or not as he, himself, determines. No employee will be urged or advised to buy any stock.

"We have been studying the problem for some time and we are convinced that our recommendation is in the best interests of both our stockholders and our employees.

"The proposal will be contained in the proxy statement for the annual meeting to be mailed to stockholders about April 22.

"If approved by stockholders we hope that a similar plan can be recommended for Northern Illinois Gas Co under which employees of the new Edison gas subsidiary can buy stock in that company.

"These plans cannot be put into effect without the approval by the Illinois Commerce Commission of the issuance of the stock and the term of its issuance. Approval will not be requested until after the stockholders have acted," the Edison chairman pointed out.

Debt of Puget Sound P&L May be Refunded

Directors of the Puget Sound Power & Light Co have approved plans to refund the company's long-term debt, Pres Frank McLaughlin has recently announced at Seattle, Wash.

The company's present indebtedness consists of $20,613,000 of 4¼% first mortgage bonds, due in 1972, and a $15 million 3% unsecured insurance company note, due in 1960.

"In view of its strong financial position, low debt ratios and the high coverage of interest charges, it is indicated that under present market conditions the company should be able to refinance at a substantial saving in annual interest costs," said McLaughlin.

The company's net income for January and February showed a 9.9% increase over that for the first two months of 1953. Its bonds, callable at 106, have been quoted at 105¾

DUXSEAL®
plugs 'em fast-to last!

DUXSEAL is a nonhardening adhesive plastic compound made with an asbestos base. It is the ideal general utility sealing and caulking compound for duct openings, potheads, bushings, terminal boxes, and for filling multi-wire contact boxes indoors. Use it like putty, just as it comes from the handy package, for smooth, workmanlike jobs.

Duxseal stays plastic—will not slump, melt or run under ordinary temperatures. Clings to duct walls and cables but flexes with expansion and contraction. It is unaffected by water and gases, does not react with rubber, metals or painted surfaces. For full information write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ontario.

JM

Johns-Manville
SEALING COMPOUNDS

bid, 107½ asked at the present time.

The directors also declared a dividend of 41¢ per share on the common stock, payable May 15 to stockholders of record at the close of business April 23, subject to the approval of the Washington State Public Service Commission. This represents an increase of 3½¢ per share over the last quarterly dividend.

The company recently reported earnings for the 12 months ended Feb. 28 at the rate of $1.88 a share, as against $1.50 a share for the previous 12 months. The new dividend rate, on an annual basis, would amount to $1.64 per share.

FINANCIAL BRIEFS

Hawaiian Electric Co has sold $6 million first mortgage bonds 3.45% due in 1984 to institutions through Dillon, Read & Co and Dean Witter & Co.

Northern Illinois Gas Co, a subsidiary of the Commonwealth Edison Co, will sell 400,000 shares of common stock to the public shortly.

Mountain States Power Co has set $1,750,000 as the price it wants if its Willakenze and Glenwood distribution system facilities are condemned by the Eugene Water & Electric Board. The board had offered $1,350,000 for the properties last December.

The Lebanese Council of Ministers' agreements with the Belgian-French Co to buy Beirut Electricity Co was signed recently in Beirut.

Loup River Public Power District of Nebraska has sold $17.6 million of revenue bonds due serially from 1959-94 to a syndicate headed by John Nuveen & Co at a net interest cost of 4.067%.

Syndicate headed by Wood, Gundy & Co is offering $12 million 3½% bonds due in 1974 of Manitoba Hydro-Electric Board at 99½ to yield about 3.53% . . . Blyth & Co has sold a secondary offering of 10,000 shares of 4.80% preferred stock of Pacific Gas & Electric Co at $28.75 a share . . . Although Consolidated Edison Co of New York has no present plans to issue common shares, stockholders will be asked on May 17 to authorize 2 million more.

FIGHT SUMMERTIME HAZARDS!

VENEX*—FOR SNAKE BITE

Here's complete treatment for snake bite in a compact pocket packet. The Venex kit is simplified so the victim can treat himself. Medically approved venom-extraction method works immediately removing poison.

ImunOak* FOR POISON OAK | **ImunIvy*** FOR POISON IVY

Build immunity or treat the effects of these poisonous plants with ImunOak or ImunIvy. Easily administered orally or injected by a physician, these extracts have proven clinical records of prompt and marked relief.

FREE: *Write for copy of folder "Poisonous Plants at a Glance."*

E. D. BULLARD COMPANY
275 EIGHTH STREET
SAN FRANCISCO, CALIFORNIA
EVERYTHING BULLARD IN SAFETY
Distributors in principal cities
*T.M. REG.

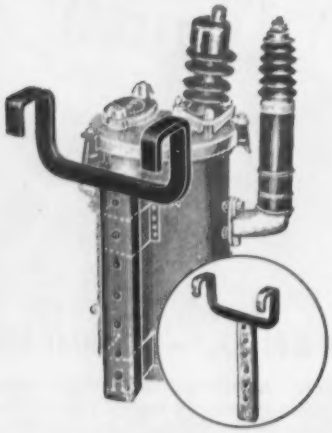
TRANSFORMER HANGERS

LOOK FOR THE NAME

THIEL

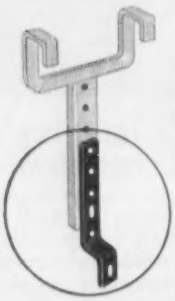
It's a Mark of Quality

Formed from heavy gauge steel . . . hot-dip galvanized for longer life. Available in two sizes. Designed to meet NEMA specifications.



Model	1-Phase	3-Phase	Weight
T-1	3-15 KVA	9 KVA	16¼ lbs.
T-2	25-37-50 KVA	15-45 KVA	37¼ lbs.

HANGER KICKERS



Model K-1 for use with T-1 hanger. Adjusts to four positions. Model K-2 for use with T-2 hanger adjusts to five positions. Kickers and bolts are hot-dip galvanized.

Hangers and Kickers in Stock

THIEL

TOOL AND ENGINEERING CO.

1417 NORTH MARKET ST.

ST. LOUIS 6, MISSOURI

TECHNICAL LITERATURE

NEMA STANDARDS—Following are available from National Electrical Manufacturers Assn, 155 E. 44th St, New York 17, N. Y.:

MB1-1954 NEMA Standards for Mining Belt Conveyors. Applies to sectional-type troughed belt conveyors and to dc and 3-phase squirrel-cage induction motors—16 pages. Price, $1.50

DA1-1954 American Standard Household Automatic Electric Flatirons. Definitions, ratings, marking, uniform test procedure, safety, and durability are covered—20 pages. Price, $1.00

VF6-1954 NEMA Standards for Black Varnished Glass Fabric—12 pages. Price, 75¢

VF7-1954 NEMA Standards for Yellow Varnished Glass Fabric—12 pages. Price, 75¢

GE BULLETINS—Following publications are available from General Electric Co, 1 River Rd, Schenectady 5, N. Y.:

GER-729A Dimming Hot Cathode Fluorescent Lamps—6 pages.

STD-5 Fluorescent Dimmer Information Letter—6 pages.

GEA-1304L Thyrite Magne-Valve Station Arresters—28 pages.

GEA-5847 How to Reduce System Investment by Distribution System Planning and Substation Selection—24 pages.

STANDARDS—"Library of Standards" is a folder describing what ASA Library is, contains, and can do for you. Library contains 60,000 standards—American and foreign. American Standards Assn, 70 E. 45th St, New York 17, N. Y.

POLYETHYLENE—Polyethylene abrasion tests are covered in No. 68 of "Kabel-items," 16 pages. Bakelite Co, 30 E. 42nd St, New York 17, N. Y.

V-BELT DRIVE—Bulletin 20B6956B, 6 pages, gives new formulas for calculating hp of v-belt drives. Allis-Chalmers Manufacturing Co, 932 S. 70th St., Milwaukee, Wis.

POTENTIOMETER NOISE—"Electrical Noise in Wire-wound Potentiometers," 12 pages, covers kinds of potentiometer noise and methods of measurement. Helipot Corp, 916 Meridian Ave, S. Pasadena, Calif.

ELECTRON TUBE RELIABILITY—"Investigation of Electron Tube Reliability in Military Applications," 97 pages, covers period April 4, 1951 to March 31, 1953 of the ARINC surveillance program. Price, 50¢. Aeronautical Radio, Inc, 1523 L Street N. W., Washington 5, D. C.

REFRIGERATOR FILM—"Design For Tomorrow," 25 min, 16 mm sound colored film, shows how a refrigerator is made. Film is intended for use by appliance dealers for educational and civic groups. Hotpoint Co, 5600 W. Taylor St, Chicago 44, Ill.

TURBINE GENERATORS—Bulletin 1969, 24 pages, covers geared-turbine generators, 200 to 1,500 kw. Worthington Corp, Harrison, N. J.

BERYLLIUM-COPPER TUBING—Data Memorandum 7-2, 9 pages, covers seamless beryllium-copper tubing. Mechanical and physical properties, heat-treating procedures, welding and brazing methods, pickling solutions, corrosion resistance tables, production limit tables, and tubing tolerances are listed. Superior Tube Co, 1520 Germantown Ave, Norristown, Pa.

STAINLESS STEEL—Alloy reference chart, 4 pages, gives chemical analyses, physical properties, and recommended applications for 28 grades of cast stainless steel. ACI, AISI, SAE, ASTN, and general type designations are given. Cooper Alloy Foundry Co, Hillside, N. J.

HANDS RELAXED

for easier, faster, safer work

Curved

5-FINGER BULLSEYE PROTECTORS

• Every detail of these Bullseye Protectors with the five curved fingers is designed to give the lineman the ultimate in comfort, safety, and ease of hand movement.

RUBBER CUFFS Patent Applied For

The finest IMPORTED GOATSKIN, ELK SKIN LEATHER, and DOMESTIC RED BUFFED HORSE HIDE are used.

LEATHER CUFFS

These leathers insure the most in flexibility and durability, remaining soft and pliable in adverse weather conditions. No shrinking — No wrinkles — No bunching. Made by workers skilled in their craft.

UNIVERSAL LEATHER CO.

114 Pierce St. Berlin, Wisc.

Now in Its 50th Year

WORLD'S GREATEST TRADE EXHIBITION

PARIS INTERNATIONAL TRADE FAIR

(FOIRE de PARIS)

May 22 to June 7

Here assembled in one location on the banks of the Seine you will find the newest industrial products, designs and equipment of France and all nations. Over the years the world famous Foire de Paris has grown in scope and importance . . . this year you will see the world's most graphic presentation of international production.

For additional information and buyer's card, write:

FRENCH CHAMBER OF COMMERCE OF U.S.

630 Fifth Ave. • New York 20, N. Y. • Phone: Circle 6-0120

MANUFACTURING BRIEFS

Square D Co, Detroit, manufacturer of electrical distribution and control equipment, plans to spend at least $1.2 million during 1954 for plant expansion.

I-T-E Circuit Breaker Co, Philadelphia, has announced a new, compact line of power system analyzers which uses 60-cycle power supply. The system analyzer can be used to solve problems resulting from continued expansion and interconnection of electrical power systems.

SALES ASSIGNMENTS

COMPANY STAFFS

Nickel Cadmium Battery Corp, Easthampton, Mass., has named Theodore Ulrich as Chicago district manager with headquarters at 122 S. Michigan Ave. He formerly was a sales engineer for Minnesota Mining Co.

Orangeburg (N. Y.) Manufacturing Co has made Thomas W. Drennen, Jr, a district sales manager to service metropolitan New York, New Jeresy, New England, Washington, D. C. and eastern Pennsylvania. Company maintains offices in New York City.

MEETINGS CALENDAR

Edison Electric Institute
Conference of Public Utility Fleet Operators, Sponsored Jointly by EEI Transportation Committee and AGA Automotive-Mobile Equipment Committee, Mount Royal Hotel, Montreal, Que.; April 20-23; 22nd Annual Convention, Atlantic City, N. J., June 1-4.

American Institute of Electrical Engineers
Conference on Feedback Control, Claridge Hotel, Atlantic City, N. J., April 21-23; Summer General and Pacific General Meeting, Hotel Biltmore, Los Angeles, June 21-25.

Maryland Utilities Association
Spring Conference, Lord Baltimore Hotel, Baltimore, April 23.

A. & M. College of Texas
7th Annual Conference for Protective Relay Engineers Department of Electrical Engineering, College Station, Tex., April 26-28.

National Association of Electric Companies
Annual Meeting, Mayflower Hotel, Washington, D. C., April 29.

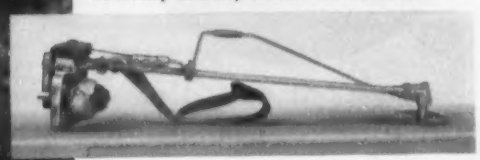
Southeastern Electric Exchange
Spring Meeting, Engineering and Operation Section, Sans Souci Hotel, Miami Beach, Fla., May 6-7.

Pennsylvania Electric Association
Joint Spring Meeting of Relay Committee and Systems Operation Committee, Bedford Springs Hotel, Bedford Springs, Pa., May 6-7.

Booklet Reveals HOW TO CLEAR BRUSH AT SIX-TO-ONE SAVINGS

BRUSHMASTER

ONE - MAN - OPERATED, MOBILE POWER-DRIVEN BRUSHCUTTER IS FASTER, SAFER, MORE EFFICIENT



ONE MAN ACCOMPLISHES WORK OF SIX!

Your company should join the ranks of those saving up to 83% on right-of-way maintenance! Brushmaster cuts all brush . . . from matted grass to saplings up to 4" in diameter . . . cuts vines, briars, honeysuckle, thorns, etc. Operates freely from right to left . . . close to ground . . . or overhead. Vibration-free, clutch controlled, positive drive.

Free Fully illustrated, colorful booklet shows secret of six-to-one savings!

BRUSHMASTER SAW, INC. Subsidiary of Harrington & Richardson, Inc., established 1871.
1084 EMERALD ST., KEENE, N. H. Manufactured and sold in Canada by H&R Arms Co., Ltd., Montreal, Canada

STRUCTURAL FITTINGS
FOR PIPE FRAMEWORK

Write for Bulletin 610

Complete line of specially designed fittings . . . These accurately made tees, elbows, crosses, flanges, etc., make neat efficient structures. They reduce assembly work to a minimum and eliminate pipe threading.

Finishes for indoor or outdoor use . . . fittings are made of the best grade of malleable iron and finished with black enamel. For outdoor service, fittings are hot-dipped galvanized.

Prompt shipment . . . we carry ample stocks of the most commonly used fittings.

ELECTRICAL ENGINEERS EQUIPMENT CO.
Melrose Park, Illinois

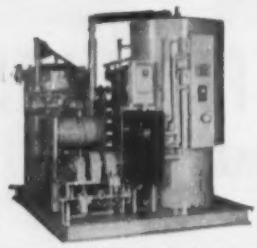
TRANSFORMER
OIL PURIFICATION
with the HILCO
HYFLOW OIL
RECLAIMER

reduces costs of

1 TRANSFORMER MAINTENANCE

2 OIL REPLACEMENT

With this 300 g.p.h. mobile Hilco Reclaimer the City of Tacoma, Washington, purified 100,000 gallons in three months at a saving of $20,000.



Cincinnati Gas & Electric Company reports an annual saving of $4,000 with this stationary Hilco Reclaimer.

The HILCO HYFLOW Oil Reclaimer combines a duplex fullers earth filter with a vacuum vaporization system to remove water, sludge, soluble oil oxidation products, paint, bushing compound, metallic soaps, etc. Oil is restored to new oil values as indicated by Neutralization Number, Interfacial Tension, and other tests.

• FOR COMPLETE INFORMATION WRITE

THE HILLIARD CORPORATION
1000 W. FOURTH ST. • ELMIRA, N. Y.

IN CANADA:—Upton-Bradeen-James, Ltd., 890 Yonge St., Toronto; 3484 Park Ave., Montreal

Pearl Optimistic . . .

. . . on Northwest energy situation, says area "will have relatively cheap power for years to come"

Although Bonneville Power Administration may have to raise its rates next year, the Pacific Northwest will have "relatively cheap power for years to come," Administrator William A. Pearl told 350 delegates to the 13th annual convention of the Northwest Public Power Association March 31-April 2 in Tacoma, Wash.

A rate rise next year is not inevitable, said Dr Pearl. Decision might be reached instead to delay the higher rates until some later date within the next five years, or to operate for the next five years at present rates, in face of an anticipated operating deficit during the last two or three years of that period.

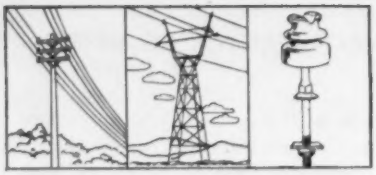
Takes Optimistic View . . . Dr Pearl predicted "there will be ample resources in the region to serve all firm loads and some of the interruptible through 1960," even in critical water years, and also took an optimistic view of the possibilities after 1960. He based his optimism on the present interest of public and private groups in obtaining leases for dam sites. He warned against the impression, however, that Bonneville has available an almost "unlimited supply of interruptible power."

During annual low-water periods in the next ten years, said Dr Pearl, there would be a shortage of 90 to 155 Mw of interruptible power in median water years and a shortage of 600 to 1,000 Mw should water conditions become critical during any year.

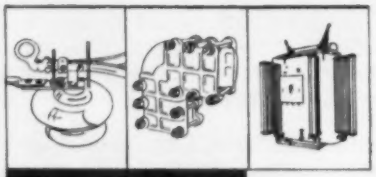
The BPA director estimated that "only approximately 17% of the potential hydroelectric power of the Northwest has been harnessed" and predicted a power demand of 10,343,190 kw in 1960.

A new clause in Bonneville contracts with power distributors which requires the customer to confer with BPA before adding any new loads of 10,000 kw or more is necessary to protect power supply for preference customers against the possibility of monopoly by one or two customers, said Dr Pearl.

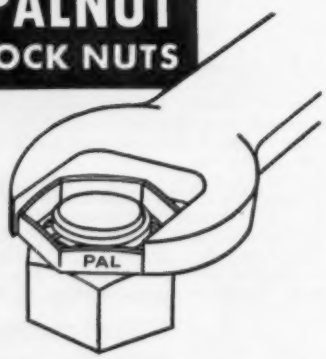
"The broadest distribution of power



Keep Nuts Tight
on all bolted assemblies



Apply low-cost
PALNUT
LOCK NUTS



PALNUT Lock Nuts cost so little, apply so fast, lock so dependably . . . you can specify them for every nut-and-bolt assembly, at negligible cost. Maintenance is reduced on mechanical assemblies—full conductivity assured on electrical connections.

PALNUT Lock Nuts may be used on new or existing equipment. Easily removed and re-used when servicing. Require only 3 bolt threads. Available in Parkerized and hot dip galvanized steel; also silicon bronze.

Send for free samples and Bulletin #577

THE PALNUT COMPANY
31 Cordier St.,
Irvington 11, N. J.

PALNUT
TRADE MARK
LOCK NUTS
for quick, secure fastening at low cost

available is one of the objectives of the BPA," he said.

Seeks to Allay Fears . . . J. Frank Ward, managing director of the Washington State Power Commission, sought to allay fears of Oregon groups that the commission seeks to monopolize all BPA power. The commission is interested only in secondary and "dump" energy, he said, perhaps to be used in conjunction with a steam power plant.

"It is not possible for any single company in the Northwest to construct a steam plant large enough to do any good," said Ward, adding that "we have no evil designs on the steam business."

The state commission proposes to discuss with the federal government use or lease-purchase of federal transmission lines and cooperation to facilitate installation of additional generators in the Chief Joseph powerhouse now under construction on the Columbia River, as well as cooperation in new construction, he said.

"The Washington State Power Commission has a clear, unlimited field to develop power in the state," said Ward. It qualifies as a public agency and thus is entitled to a priority on power from federal projects, together with other public agencies, he pointed out.

Ward strongly supported the "preference clause" in present power contracts, declaring that not even the private power companies of the area could contend it has acted to the detriment of area's power users.

Sees Public Power Jeopardized . . . Alex Radin, general manager of the American Public Power Association, described the future of public power as in jeopardy, because of "no new starts of power projects, proposals for contracts which would seriously undermine the rights of the local public power systems and rural electric cooperatives" and a campaign of "unprecedented magnitude" by the private utilities against public power.

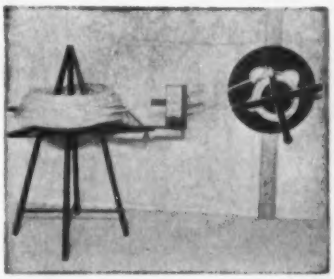
"The continued growth of public power, along with an equally vigorous expansion of private power sources, is necessary to maintain competition in the industry and to assure the abundance and low cost of electric power," maintained Radin.

Principal resolution passed at the meeting pledged the association to

(*Continued on page* 231)

Save Time! Save Wire! SAVE with a new HYKON

WIRE MEASURING Unit



MODEL SRM-1B Unit features Storeroom Reel, Wire Meter and Take-up Reel for quick, easy and accurate measuring and coil handling. Compact, portable, all-welded construction. Meter reads up to 1000 ft. Accuracy guaranteed. Take-up Reel holds up to 1500 ft. of No. 14 wire. Outer spokes on reel unlock instantly for quick coil removal. Hundreds in use. Write for Catalog.

HyKon MANUFACTURING CO.

Box 923H,
ALLIANCE, OHIO

***If* . . . You Change Your Address**

Be sure to notify us at once so future copies of Electrical World will be delivered promptly.

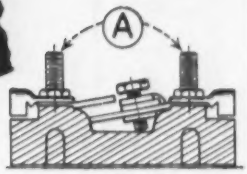
Also make certain you advise your local Postmaster, so other important mail doesn't go astray. Both the Post Office and we will thank you for your thoughtfulness.

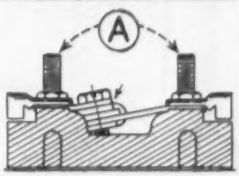
Send your new and old address to: Subscription Dept.

ELECTRICAL WORLD

330 W. 42nd St. New York 36, N. Y.

STATES TYPE NT TERMINAL BLOCKS ALLOW CIRCUIT CHECK WITHOUT DISTURBING PERMANENT WIRING





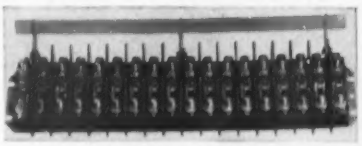
A. Just attach instrument to terminal posts.

B. Slide link out of contact—take reading.

C. Slide link back and bolt in position.

Test with the best! Make your circuit testing easier, safer, quicker with States Terminal Blocks. No guesswork—no chance of wrong wiring being put back in wrong place when checking circuit in and out of Terminal Blocks. Also, with States sliding link feature, you do *not* disturb permanent wiring. Built in any number of poles desired, front or back connected, with or without coding strip, with or without cover.

Sample gladly sent—Prompt delivery always



From 1 to 60 poles

THE STATES COMPANY

THE STATES COMPANY,
19 New Park Ave., Hartford, Conn.
Please send for Cat. 1, Sect. 6, for further details.
Name..... Title.....
Firm .....
City..... Zone.... State.....

he's working for you

THIS FELLOW IS TRAINED IN YOUR BUSINESS. His main duty is to travel the country — and world — penetrating the plants, laboratories and management councils . . . reporting back to you every significant innovation in technology, selling tactics, management strategy. He functions as your all-seeing, all-hearing, all-reporting business communications system.

THE MAN WE MEAN IS A COMPOSITE of the editorial staff of this magazine. For, obviously, no one individual could ever accomplish such a vast business news job. It's the result of many qualified men of diversified and specialized talents.

AND, THERE'S ANOTHER SIDE TO THIS "COMPOSITE MAN," another complete news service which complements the editorial section of this magazine — the advertising pages. It's been said that in a business publication the editorial pages tell "how they do it"—"they" being all the industry's front line of innovators and improvers — and the advertising pages tell "with what." Each issue unfolds an industrial exposition before you—giving a ready panorama of up-to-date tools, materials, equipment.

SUCH A "MAN" IS ON YOUR PAYROLL. Be sure to "listen" regularly and carefully to the practical business information he gathers.

McGRAW-HILL FOR BUSINESS

McGRAW-HILL PUBLICATIONS

Advertising In This Issue

Advertising Council, Inc. 228
Air Preheater Corp. 57
Aircraft-Marine Products, Inc. ... 52
Allis-Chalmers Mfg. Co.....2nd Cover
9, 28, 29, 37, 60, 164, 165
Aluminum Co. of America.....46, 47
American Blower Corp. 70, 71
Anaconda Wire & Cable Co..... 36
"Automatic" Sprinkler Corp. of America 194

Bakelite Co., Div. Union Carbide & Carbon Corp. 8
Baltimore & Ohio Railroad..... 56
Bechtel Corp. 41
Bell Telephone Laboratories..... 69
Blackburn Corp., Jasper 44
Brushmaster Saw, Inc..... 225
Bullard Co., E. D. 223

C-O-Two Fire Equipment Co..... 72
Cable Spinning Equipment Co.... 211
Canadian Line Materials Ltd..... 23
Central Transformer Corp..... 13
Chance Co., A. B.....163, 189, 197
Charleston Rubber Co. 184
Chase Brass & Copper Co., Inc... 84
Chevrolet Div. General Motors... 218
Cochrane Corp. 7
Cole Electric Co. 234
Combustion Engineering, Inc...20, 21
Consolidated Treating Co. 16
Continental-Diamond Fibre Co.... 35
Cope, Inc. T. J. 64
Crescent Tool Co..... 82

DeLaval Separator Co..... 39
Delco-Remy Div. General Motors Corp. 152, 153
Directory of Engineers.....230, 231
Dow Chemical Co., The..... 205
Driver-Harris Co. 65
duPont de Nemours & Co. (Inc.)
Grasselli Chemicals Dept.....75, 190
Rubber Chemicals Div.....26, 27
Duncan Electric Mfg. Co. 48

Eastern Specialty Co. 198
Ebasco Services, Inc..... 193
Eisler Engineering Co., Inc..... 222
Electric Machinery Mfg. Co..... 159
Electric Service Mfg. Co.....80, 81
Electric Service Engineering Co... 188
Electrical Engineers Equip. Co.... 225
Electro Switch Corp. 212
Electroline Company 5
Engineers, Directory of.....230, 231
Everstick Anchor Co. 158

Federal Electric Products Co. 3rd Cover
French Chamber of Commerce of U. S. 224

G&W Electric Specialty Co., Inc.. 59
Gai-Tronics Corp. 201
General Cable Corp. 34
General Electric Co.
Apparatus Dept.....131, 132, 133
135, 136, 137
139, 140, 141
Gould National Batteries, Inc..... 157
Green Fuel Economizer Co., Inc... 162
Gulf Oil Corp. 31
Guth Co., The Edwin F..... 151

Haley & Co., Inc. R. G..... 192
Hazard Insulated Wire Works... 4
40, 66
Hi-Voltage Equipment Co.....54, 55
Hilliard Corp., The..... 226
Hotpoint Co. 77
Hubbard & Co. 187
Hykon Mfg. Co. 227

Indiana Steel & Wire Co..... 183
I-T-E Circuit Breaker Co.....92, 93
I-T-E Circuit Breaker Co.
R & I E Equipment Div..... 17
Irvington Varnish & Insulator, Div. Minnesota Mining & Mfg. Co. 30

Jenkins Brothers 91
Johns-Manville 223
Joslyn Mfg. & Supply Co.....62, 63

KPF Electric Co. 79
Kaiser Engineers Div. Henry J. Kaiser Co. 154
Kearney Corp., James R.....50, 51
Kerite Co., The 98
Kidde & Co., Inc., Walter..... 90
Kimble Insulator Div. Owens-Illinois 94
Koppers Co., Inc. 208, 220
Kuhlman Electric Co.....4th Cover

Lapp Insulator Co., Inc..... 49
Leeds & Northrup Co., The..... 155
Line Material Co. 23, 85, 86
87, 88, 89
Locke Dept. General Electric Co. 32, 33

Mallory & Co., Inc., P. R..... 207
McCabe-Powers Auto Body Co... 45
Minneapolis-Honeywell Regulator Co., Industrial Div. 202, 203
Mitts & Merrill 222
Moloney Electric Co. 160, 161

North American Aviation, Inc.... 22

O. Z. Electrical Mfg. Co., Inc..... 78
Ohio Brass Co.....147, 148, 149, 150
Okonite Co., The.....4, 40, 66
Orangeburg Mfg. Co., Inc..... 209

Pacific Coast Engineering Co..... 6
Pacific Electric Mfg. Corp..... 83
Page Steel & Wire Div. American Chain & Cable 196
Palnut Co., The 226
Paris International Trade Fair... 224
Pennsylvania Transformer Co..199, 200
Permutit Co. The 53
Philadelphia Gear Works, Inc... 74
Philco Corp., Industrial Div...10, 11
Pittsburgh Coke & Chemical Co. Agricultural Chemicals Div..... 67
Porcelain Products, Inc..... 68
Preformed Line Products Co...18, 19
Pritchard & Co., J. F..... 185

Reel-O-Matic Corp..... 215
Reliable Electric Co. 73
Revere Copper & Brass, Inc..... 143
Riley Stoker Corp. 24, 25
Ripley Co., Inc. 195
Roebling's Sons Corp., John A... 38

Sangamo Electric Co.....42, 43
Seachlight Section 232, 233
Simplex Wire & Cable Co..... 61
Snap-On Tools Corp. 210
Southern States Equipment Corp.. 221
Sprague Electric Co. 231
Square D Co. 95
Standard Transformer Co.....96, 97
States Co., The 227
Stone & Webster Engineering Co. 217
Sylvania Electric Products, Inc... 214

Thiel Tool & Engineering Co..... 224
Thompson Chemicals Corp..... 58
Tulsa Winch Div. of Vickers, Inc. 213

Union Carbide & Carbon Corp. Bakelite Div. 8
United States Rubber Co..... 12
Universal Leather Co..... 224
Uptegraff Mfg. Co., R. E..... 76

Victor Insulators, Inc. 191

Wagner Electric Corp. 14, 15
Westinghouse Electric Corp...167, 168
169, 170, 171, 172, 173, 174, 175
176, 177, 178, 179, 180, 181, 182

■

PROFESSIONAL SERVICES.....230-231

■

SEARCHLIGHT SECTION

(Classified Advertising)

H. E. Hilty, Mgr.

EMPLOYMENT
Positions Vacant 232
Selling Opportunities Offered..... 232
Positions Wanted 232
Selling Opportunities Wanted..... 232
Employment Services 232

EQUIPMENT
(Used or Surplus New)
For Sale 232, 233

PROFESSIONAL SERVICES

Consulting **Management** **Designing** **Inspections**
Accounting **Appraisals** **Testing** **Cost Analysis**
Valuations **Construction** **Financing** **Investigations**

BARKER & WHEELER

Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
36 State Street, Albany, N. Y.

FORD, BACON & DAVIS

Engineers

DESIGN • CONSTRUCTION
VALUATIONS • REPORTS

New York • Chicago • Los Angeles

N. A. LOUGEE & COMPANY

Engineers and Consultants

REPORTS — APPRAISALS
DEPRECIATION STUDIES — RATE CASES
BUSINESS AND ECONOMIC STUDIES

120 Broadway New York

BLACK & VEATCH

Consulting Engineers

Electricity—Water—Sewage—Industry

Reports, Design, Supervision of Construction, Investigations, Valuation and Rates

4706 Broadway Kansas City 2, Missouri

GILBERT ASSOCIATES, Inc.

Engineers • Consultants • Constructors
Reading, Pa.

Engineering and Design • Construction Supervision
Industrial • Sanitary • Safety
Chemical Laboratory Services
Business and Economic Research
Industrial Relations • Purchasing

New York Philadelphia Washington
Rome Manila Medellin

LUCAS & LUICK

Engineers

DESIGN, CONSTRUCTION, SUPERVISION, OPERATION, MANAGEMENT, APPRAISALS, INVESTIGATIONS, REPORTS, RATES

231 S. LaSalle St., Chicago

THEODORE D. BROSS & COMPANY

Steel Tower & Wood
Transmission Lines

Distribution & Maintenance

175 Enfield St. Hartford, Conn.

HARZA ENGINEERING CO.

Consulting Engineers

E. MONTFORD FUCIK CALVIN V. DAVIS
Hydroelectric Plants and Dams
Transmission Lines
Flood Control, Irrigation
River Basin Development

400 West Madison Street Chicago 6

LUTZ & MAY

Consulting Engineers

STEAM, GAS & DIESEL POWER STATIONS
PUMPING PLANTS—ELECTRIC SYSTEMS
REPORTS—DESIGN—APPRAISALS

1009 Baltimore Kansas City 6, Mo.

DAY & ZIMMERMAN, INC.

Engineers

Design - Construction - Management
Investigations and Reports

New York Philadelphia Chicago

HOOSIER ENGINEERING COMPANY

Erecting Engineers
Transmission Lines, Substations

1384 Holly Avenue, Columbus, Ohio

CHAS. T. MAIN, INC.

Engineers

Electric, Steam and Hydraulic Projects, Investigations, Reports, Designs and Appraisals

Chamber of Commerce Building
80 Federal St., Boston 10, Mass.

Doble Engineering Company

Electrical Insulation Engineers

Field Testing and Maintenance of High Tension Insulation, Special Problems in Electrical Communications

Office and Laboratory: Doble Park
Box 344, Belmont 78, Mass. (6 miles from Boston)
Branch Office: 30 N. Wacker Dr. Chicago, Ill.

JACKSON & MORELAND

Engineers and Consultants

Design and Supervision of Construction
Reports—Examinations—Appraisals
Machine Design—Technical Publications

Boston New York

MINER and MINER

Consulting Engineers
Incorporated

Greeley Colorado

Ebasco Services Incorporated

Engineers - Constructors - Business Consultants

Design and Construction
Financial and Operating Consultation
Investigations and Reports
Consulting Engineering

Two Rector Street New York
Chicago • Washington, D. C.

THE KULJIAN CORPORATION

Engineers • Constructors - Consultants

Power Plant Specialists

Utility - Industrial - Chemical

1200 N. Broad St., Philadelphia 21, Pa.

ARTHUR L. MULLERGREN

Engineering - Management
Public Utilities—Natural Gas

Kansas City, Mo.

ELECTRICAL TESTING LABORATORIES, INC.

Electrical, mechanical, photometric, radiometric and chemical laboratories, rendering testing, research and associated services, including certification, inspections at factories and field investigations.

2 East End Avenue at 79th St., New York 21, N. Y.

LARAMORE and DOUGLASS, INC.

Consulting Engineers

Power Plants
Transmission Distribution
Design — Reports — Appraisals — Rates

79 East Adams Street
Chicago 3, Illinois

PIONEER SERVICE & ENGINEERING CO.

Consulting and Design
Engineers . . Purchasing . .
Specialists in Financing
Accounting and Other Operations

231 So. La Salle St. Chicago 4

ROBERT E. FOLEY CONSTRUCTION CORPORATION

Construction & Maintenance

Transmission—Distribution—Communication Lines
Substation, Radio and Television Towers

48 Griswold St. Binghamton, N. Y.

Peter F. Loftus Corporation

Engineering and Architectural
Consultants and Designers

First National Bank Bldg.,
Pittsburgh 22, Pennsylvania
Cable Address—"LOFTUS Pittsburgh"

Recording & Statistical Corp.

BILL ANALYSIS—CONSUMPTION STUDIES

THE ONE-STEP METHOD
(exclusive with R&S)

100 Sixth Ave. WOrth 6-2700 New York 13, N. Y.

PROFESSIONAL SERVICES

REIS & CHANDLER, INC.
ADVISORS TO UTILITIES
Financing—Rate of Return
30 Vesey Street, New York 7, N. Y.

SANDERSON & PORTER
Engineers and Constructors
New York • Chicago • San Francisco

SARGENT & LUNDY
ENGINEERS
140 South Dearborn St.
Chicago, Ill.

F. W. SCHEIDENHELM
Consulting Engineer
Hydraulic Engineering, Hydro-electric Development, Water Supply, Flood Control. Engineering Problems relating to Water Rights and Water Power Law. Appraisals.
50 Church Street, New York 7, N. Y.

F. A. TUCKER, INC.
Contractors—Engineers
specialize in
Distribution - Transmission - Telephone lines - Maintenance - Roads - Bridges Dams
Main Office—88½ Center Street, Rutland, Vt.
Branch Office—120 East 3rd St., Charlotte, N.

UTILITIES LINE CONSTRUCTION COMPANY, INC.
Construction and Maintenance
Transmission - Distribution
Electric and Telephone Lines
Consultants
805 York Road Jenkintown, Pa.

THE J. G. WHITE ENGINEERING CORPORATION
Design • Construction • Reports • Appraisals
80 Broad Street, New York 4

READERS MAY CONTACT
the consultants whose cards appear on this page with the confidence justified by the offering of these special services NATIONALLY.

NPPA Meeting

(*Continued from page* 227)

"cooperate with other civic groups of the region in the preparation and sponsorship in the Congress on a bipartisan basis of legislation creating a regional public organization to carry forward the Northwest power program on a basis of assuring an adequate power supply, at the lowest possible rates consistent with comprehensive development of water power resources of Pacific Northwest."

New Officers . . . Ora Beasley of Northern Lights, Sandpoint, Idaho, was elected new president of the association with V. B. Jones of Tacoma City Light as vice president, and Ed Cooney, Cowlitz County PUD, as treasurer.

Power Pool Proposed for Puget Sound Area

Formation of a power pool for the Puget Sound area of western Washington, to work within the general framework of the existing Northwest Power Pool, has been proposed at Seattle, Wash., by Paul J. Raver, City Light superintendent.

Principal members of the pool presumably would be the City Light departments of Seattle and Tacoma, who now interchange power and both of whom are in need of additional generating capacity.

The pool, which would be intended to carry out a coordinated program of power resources development, would include all public and private agencies operating in the area, said Raver. This presumably would include Puget Sound Power & Light Co of Seattle, Snohomish County PUD of Everett, and Skagit PUD of Mount Vernon. All members would work together in planning their power developments to fit into a general program.

Raver cited a proposed steam power plant in Seattle as a project which might be worked into the operation of such a power pool.

"If the power generated in that steam plant were to be made available, when necessary, to a Puget Sound power pool," said Raver, "it would be logical that the construction costs might be spread over the area to some degree. It might be desirable to have the plant of larger size than if it were for City Light use alone."

Power Line RADIO & TV Interference Sources Located . . . QUICKLY & EASILY!

Sprague's Interference Locator is the ideal portable instrument for fast, easy location of noise sources on power lines and electrical equipment.

Compact, rugged and easily operated, the 8-tube superhet circuit covers frequencies from 550 kc to 30 mc — operates from self-contained dry battery, auto battery or 115-volt mains. Features include loop and collapsible rod antennas, integral loud speaker, built-in dual range output and battery test meter, calibrated r-f and audio gain controls, and beat-frequency oscillator. Write for Bulletin PF-601 to:

SPRAGUE ELECTRIC COMPANY
315 Marshall Street,
North Adams, Mass.

SPRAGUE
Pioneers in Electric & Electronic Development

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT: BUSINESS: "OPPORTUNITIES" :EQUIPMENT :USED OR RESALE

POSITIONS OPEN

for

RATE ENGINEERS

Large established New York consulting firm has openings for Rate Engineers experienced in all phases of electric or gas utility rate making and regulatory practices.

These are staff positions with good salaries and advancement opportunities. Some traveling necessary.

Our employees know of these openings

Please submit resume including experience, personal data and education. Replies will be held in strict confidence.

P-2392, Electrical World
330 W. 42 St., New York 36, N. Y.

Openings for

PUBLIC UTILITY SYSTEMS & METHODS MEN

Established New York engineering and consulting firm has openings for men experienced in utility systems and methods.

Applicants must be interested in training and development for work in the study, design and installation of ELECTRONIC DATA PROCESSING systems in accounting and related fields.

Write giving experience, age, earnings, etc.

P-2326, ELECTRICAL WORLD
330 W. 42 St., New York 36, N. Y.

ELECTRICAL WIRE AND CABLE

—YOUR BEST SOURCE—

- for every industrial and power application
- odd lengths—long and short—reasonably priced
- largest stock in Midwest
- varnished cambric — leaded — neoprene

Let us quote on requirements—send your inquiries

DELIVERY

QUICK . . . from stock
We'll also buy your Surplus
Branch Offices:
Houston—Yukon 5547
Los Angeles—DUnkirk 7-3265

UNIVERSAL Wire and Cable Co.
2900 N Clybourn Ave., Chicago 14, Ill.
EAstgate 7-4777 Code: UNIWIRE

WANTED
YOUNG ELECTRICAL ENGINEER
FOR SYSTEM PLANNING AND RELAY WORK IN GENERAL OFFICE
CENTRAL ILLINOIS PUBLIC SERVICE CO.
SPRINGFIELD, ILLINOIS
ATT: ELECTRICAL ENGINEER

TURBO GENERATOR
Available Immediately
7500 KW G. E. Co.
180 P.S.I.—625°F Total Temp.
3 phase 60 cycle 2300 volt
With Surface Condenser
GOOD CONDITION
Union Electric Co. of Missouri
315 N. 12th Blvd. St. Louis 1, Mo.

—TRANSFORMERS—

BOUGHT AND SOLD

We carry a large stock of rebuilt and guaranteed transformers, and invite your inquiries.

Custom-built transformers and coils manufactured to your specifications.

Expert Repair Service—all makes and sizes of transformers rewound, repaired and redesigned. Ask for our price schedule.

THE ELECTRIC SERVICE CO., INC.
5331 Hetzel St. Cincinnati 27, Ohio
40 Years' Dependable Service

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

WANTED: ELECTRICAL Design Engineer with exceptional ability and successful experience in the design and testing of light duty electrically operated remote controlled oil filled and dry type outdoor switching devices from 120 volts to 15 KV. This is an exceptional opportunity for an engineer capable of producing simple and practical designs for low volume production. Advancement is assured and salary attractive. The position is permanent with an established small manufacturer in Indiana. Give experience, education, references, age, recent photo if available, and salary expected. P-1621, Electrical World.

DISTRIBUTION ENGINEERS—Two competent experienced graduate Electrical Engineers, with approximately 10 years experience design, operation and maintenance of distribution facilities in established rapidly growing utility located South America. Reply giving resume education, experience and personal data. Box P-2431, Electrical World.

METER SUPERINTENDENT — Established rapidly growing utility in Brazil requires competent technician with 10 years experience Meter Department of U. S. or large Latin American Public Utility to supervise Meter Departments several operating companies. Single man preferred as considerable traveling involved. Reply giving resume education, experience, and personal data. Box P-2432, Electrical World.

EMPLOYMENT SERVICES

SALARIED PERSONNEL, $3,000-$25,000. This confidential service established 1920, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. L, 241 Orange St., New Haven, Conn.

SALARIED POSITIONS $5,000 to $35,000. We offer the original personal employment service (established 44 years.) Procedure of highest ethical standards is individualized to your personal requirements. Identity covered, present position protected. Ask for particulars, R. W. Bixby, Inc., 658 Brisbane Bldg., Buffalo 3, N. Y.

SELLING OPPORTUNITY OFFERED

REPRESENTATIVES FOR selling of electrical Insulating Varnishes, high grade electrical varnished Tubing & Sleeving. Good contact with industries essential. RW-2366, Electrical World.

POSITIONS WANTED

EXPERIENCED SWITCHBOARD Operator would like operating job in central or substation. PW-8267, Electrical World.

ELECTRICAL ENGINEER with 5-years construction and utility experience available for assignment. Capable of design and estimating for industrial installations, line construction. Desires position requiring initiative and responsibility. PW-2071, Electrical World.

SALES ENGINEER, Electrical B.S. degree, 15 years experience, desires new connection Pacific Northwest. PW-2314, Electrical World.

GRADUATE ENGINEER. Five years experience electric distribution. Desires connection with medium size municipal P. & L. in eastern U. S. PW-2335, Electrical World.

SELLING OPPORTUNITY WANTED

SALES AGENT now calling on wholesale distributors of electrical and allied products servicing large installation contractors and industrial users of High Voltage Equipment. New item. Large volume potential. Nationally known aluminum products manufacturer. Protected territory; commission basis. Advise full particulars, items now carried and territory covered. Replies held confidential. Box RA-2452, Electrical World.

"Opportunity" Advertising
Think
"SEARCHLIGHT"
First

OPPORTUNITIES!

in

New and used equipment recently released from service by a number of electric and gas utility companies

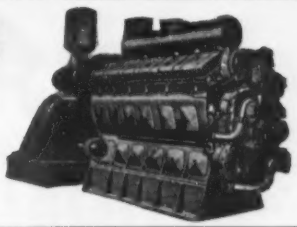
POWER PLANT EQUIPMENT
CONSTRUCTION EQUIPMENT
SUBSTATION EQUIPMENT
TRANSMISSION LINE MATERIALS

Send for new list, . . . to

EBASCO SERVICES INCORPORATED
(APPARATUS EXCHANGE)
Two Rector St., New York 6, N. Y.

DIESEL POWER

IMMEDIATE SHIPMENT
• PURCHASE OR RENTAL
UNIT CAPACITIES—10 TO 2475 KVA
A.C.—50 AND 60 CYCLES
• ALSO D.C. UNITS



A PARTIAL LISTING OF OUR INVENTORY

KW	Make	Model	HP	RPM	KW	Make	Mode	HP	RPM
1180	Worthington	8EH-8	1685	360	400	Ingersoll-Rand	S-8	600	720
1136	Fairbanks Morse	38D	1600	720	350	Baldwin	VO-6	510	450
1100	General Motors	16-278A	1600	720	320	Enterprise	DSG-6	560	450
750	General Motors	12-567	1080	720	300	General Motors	8-268A	450	1200
700	Worthington	EE-8	1000	327	200	General Motors	8-268A	350	900
500	General Motors	8-278A	750	720	150	Worthington	CC-4	225	450
500	General Motors	8-567	720	720	150	Ingersoll-Rand	S-4	225	600
500	Alco	6-12½x13T	750	600	150	Buckeye	80	240	600
480	Worthington	DD-8	700	360	100	General Motors	3-268A	150	1200
400	Sterling	VDS-8	600	1200	60	General Motors	6-71	90	1200

A. G. SCHOONMAKER COMPANY, INC.
DIESEL DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.

REBUILT AND NEW

GUARANTEED MOTORS
M.G. SETS • GENERATORS
Hoists • Compressors • Transformers
Units of Every Size and Description

D. C. MOTORS 230 Volt

HP	Make	Type	Speed
250	Westg.	SK-201	850
250	Westg.	SK-220	450/800
250	G. E.	MPC-4	700
200	Cr. Wh.	CM	500
175	G. E.	ELC	750
100	G. E.	MPC	400/800
100	G. E.	RC-34	2500
100	G. E.	RC-19	575
100	G. E.	MPC	400
50	G. E.	RC-31B	1700
50	G. E.	RC-35	700
50	G. E.	DCC-204	650
40	A. C.	E-140	750
30	Cr. Wh	CCM-504	450
25	Westg.	SK-1006	1100
25	G. E.	RC-32	800
25	A. C.	E-130e	775
25	Westg.	SK-133	575
20	Star	SB-10	1750
20	G. E.	CD-85	1150
20	Westg.	SK-1106	750

And Many Others

WE'LL SELL, BUY OR TRADE
PHONE CANAL 6-2900
CHICAGO *Electric Co.*
1324 W. CERMAK ROAD
CHICAGO 8, ILL.

J. L. HEMPHILL & CO.

ELECTRICAL ENGINEERS & EQUIPMENT
1606 53rd ST., NORTH BERGEN, N. J. N. Y. C. Tel. LOngacre 5-3227 N. J. Tel. UNion 3-7400

TRANSFORMERS
2— 750 KVA G.E., 3 Ph., 4150V. 120/240V. sec.
2— 750 KVA G.E., 1 Ph., 4600V. 115/230
2— 400 KVA Pitts., 1 Ph., 2400/4800V. 240/48V.
3— 333 KVA Whse., 1 Ph., 2400V. 600 V. sec.
2— 300 KVA G.E., 1 Ph., 13200V. 220/440V.
1— 200 KVA G.E., 3 Ph., 2400-220 sec.
3— 200 KVA G.E., 1 Ph., 13200V. 440V.
1— 200 KVA G.E., 3 Ph. 4150V., 3 Ph. 2400V., Auto.

SYNCHRONOUS MOTORS
1— 300 H.P., Elec. Mach., 720 RPM. 3 Phase 60 cyc., 2200V T E F Cooled Outdoor service.
1— 150 H.P., G.E., 1800 RPM. 220V. 3/60.
2— 150 H.P., Al. Chal. 360 RPM. 440V. 3/60.

MOTOR GENERATOR SETS
1—1000 KW Whse., 600 V. 720 RPM. 4000 Syn.
1—1000 KW G.E., 600 V. 514 RPM. 4000 Syn.
1—1000 KW Whse., 275 V. 720 RPM. 4000 Syn.
1— 200 KW Whse., 250V., 900 RPM. 4000V. Syn.
1— 150 KW G.E., 126/250V. 1200 RPM. 2300 Syn.
1— 100 KW G.E., 250V. 900 RPM. 2300V. Syn.

SLIP RING MOTORS
2— 500 H.P., G.E., M 1200 RPM 2400 V.
1— 400 H.P., West., CW. 450 RPM. 550V.
1— 250 H.P., West., CW. 600 RPM. 440V.
1— 200 H.P., West., CW. 600 RPM. 440V.
3— 150 H.P., Al. Ch. 1800 RPM. 2300V., 3PH. 60 Cy.
Large Stock of A.C. and D.C. Equipment

SUBSTATION EQUIPMENT

TRANSFORMERS

QU.	KVA	MFR.	VOLTAGE
4	2500	Mol.	69000—13800
4	500	West.	69000—6900
3	400	G. E.	66000/33000—2300/4160
3	333	Stand.	69000/34500—7200/12470 Y
3	200	Pitts.	66000—2300
3	1250	A. C.	44000/11500
4	150	West.	44000/33000—2300/6900
3	75	West.	44000—7200/12470 Y
3	5000	G. E.	38100/66000—6600
4	4500	G. E.	3600—13300—2400
3	3333	G. E.	33000/11000—2400/7200
3	333	G. E.	33000—7200/12470 Y
3	250	Mol.	33000—13800/23900 Y
3	200	A. C.	34500—2400/7200/12470 Y
3	75	Wag.	33000—7200/12470 Y
3	1250	G. E.	25400/13200—2400
4	1500	A. C.	25400/44000 Y—6900/13800
3	100	G. E.	22000—7200/12470 Y
3	50	G. E.	22000—2300
1	600	Stand.	13200—2300, 3 ph
1	450	Penna.	13200—2400, 3 ph. ASKAREL
3	200	G. E.	13200—2400/4160 Y
3	250	Pitts.	7200—220/440
3	150	Wag.	6900—2300
3	37½	G. E.	6900—230/460
4	150	G. E.	4800/2400—240/120
2	100	G. E.	4800/2400—480/240
3	333	G. E.	2400/4160 Y—240/480
3	250	G. E.	2300/4000 Y —115/230
3	200	West.	2400—240/480
3	150	West.	2400—230/115
1	100	G. E.	2300—575, 3 ph.
6	50	West.	2400—114/228 DRY TYPE

INDUCT. REGULATORS—Outdoor
1— 390 KVA G. E.-Step 541 amp. 4160 V. 3 ph.
3— 96 KVA G. E. 200/400 Amp. 2400 V. 1 ph.
3— 48 KVA West. 200 A. 2400 V. 1 ph.
8— 36 KVA West. 150/300 A. 2400 V. 1 ph.
2— 36 KVA G. E. 75/150 A. 4800 V. 1 ph.

CIRCUIT BREAKERS
4— 800 A. 132 KV West. G-222A-2500 MVA
2— 400 A. 37 KV G. E. FHKO-136-350 MVA
2—4000 A. 15 KV G. E. FHKO-139-1000 MVA
2—2000 A. 15 KV G. E. FHKO-239-1500 MVA
1—1200 A. 15 KV G. E. FKO-139-350 MVA
4— 600 A. 15 KV G. E. FHKO-139-750 MVA

BREW, WOLTMAN & CO., INC.
52 Church Street New York 7, N. Y.

Accepting bids on following new G.E. material immediate deliver;

1—Transformer 500 K.V.A. 22.9 K.V. to 4.1 K.V.

3—Transformer 333 K.V.A. 4.1 K.V. to 480 V.

3—Oil circuit breakers type F.K. 0-227

1—Steel substation structure 4.1 K.V.

1—480V Air circuit breaker cabinet with 1 Type A.L. 2-50 and 4 type A.K. 1-15 breakers

Write J. S. GABRIEL,
Purchasing Agent,
Denver & Rio Grande Western R.R. Co.,
P. O. Box 2040, Denver 1, Colorado

RE-NU-BUILT
GUARANTEED

ELECTRIC POWER EQUIPMENT

MOTOR GENERATOR SETS
3 ph., 60 cy.

Qu.	KW	Make	Speed	DC Volts	AC Volts
1	—3000 3U	G.E.	514	600	4000/13200
2	—2000/2400	G.E.	450	250/300	2300/4600
2	—2000	G.E.	514	600	6900/13200
1	—2000	G.E.	500	666 25 cy.	11000
2	—2000	G.E.	450	600	2300/4600
1	—1500	C.W.	514	115	4000/13800
1	—1500	G.E.	720	600	13200
1	—1000	G.E.	900	260	4100/6900
2	—1000	Whse.	900	600	2300/4150
3	—1000	G.E.	720	600	2300/4600
1	—750	Whse.	900	275	2300/4150
1	—500	Whse.	1200	125/250	2300
1	—500	Whse.	900	250	440
1	—500	G.E.	720	125	2300

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	—4000	G.E.	Condensing—425 lbs—750° F.T.T.—Surface Condenser 3/60/2300-4000 v with exciter
1	—1000	G.E.	Non-Cond—190 lbs-2400-3-60
1	—1000	Moore	Condensing—Extraction—190 lbs., 2400-3-60—Surface Cond.
1	—750	G.E.	Condensing—265 lbs., 440-3-60 Built 1944
1	—500	Moore	Non-Cond—150/200 lbs., 5/35 lbs. B.P., 480-3-60 Dir. Conn. Exciter
1	—300	G.E.	Non-Cond—150/175 lbs., 5/10 lbs. B. P., 480-3-60

FREQUENCY CHANGERS

Qu.	Kva	Make	Cycles	Voltages
1	—13900	Whse.	60/25	13200 x 13200
1	—3750	G.E.	60/25	4150/2400 x 2400/4150
1	—3125	G.E.	25/60	4150/2400 x 2400/4150
2	—2500	G.E.	25/62½	2300 x 4150
1	—1250	G.E.	25/58.3	4400 x 2300
1	—625	A.C.	25/60	11000 x 2300

TRANSFORMERS—60 Cycle

KVA	Make	Type	Ph	Voltages
1—5000	Whse.	OISC	3	33000x26400/13200
1—2500	Whse.	OISC	3	26400/13200 x 480
3—2000	G.E.	HVDDJ	1	66000 x 13800
1—1500	G.E.	HT	3	13200 x 2300
3—1250	G.E.	HVDDJ		6600/550
3—1000	G.E.	HVDDJ	1	2200/480

BELYEA COMPANY, INC.
51 Howell Street, Jersey City 6, N. J.

Cole Electric Co.

8439 Steller Drive TExas 0-4701 Culver City, Calif.

AIR BREAK DISCONNECTING SWITCH

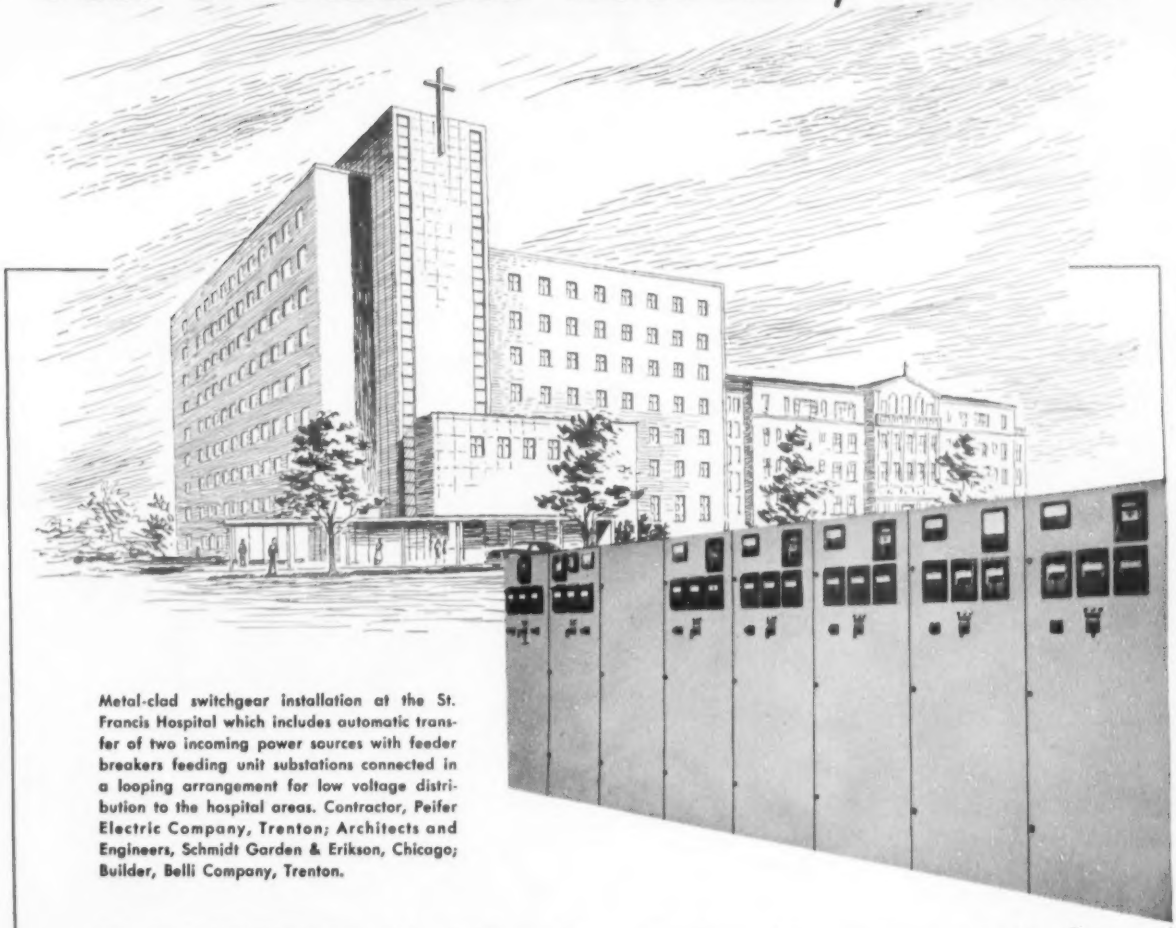
34,500 volts — 600 amperes — Type O-2

Vertical break. Three pole. Single throw. Group operated.

One pole shown.

SILVER TO SILVER CONTACTS

IT'S FEDERAL-PACIFIC SWITCHGEAR FOR ST. FRANCIS HOSPITAL, TRENTON



Metal-clad switchgear installation at the St. Francis Hospital which includes automatic transfer of two incoming power sources with feeder breakers feeding unit substations connected in a looping arrangement for low voltage distribution to the hospital areas. Contractor, Peifer Electric Company, Trenton; Architects and Engineers, Schmidt Garden & Erikson, Chicago; Builder, Belli Company, Trenton.

IN THE NEW WING of the St. Francis Hospital, Trenton, N. J., the entire electrical system is controlled by Federal-Pacific equipment. The installation includes a 5 K. V. metal-clad switchgear installation employing magnetic air break circuit breakers, unit substations, and necessary lighting and distribution panelboards.

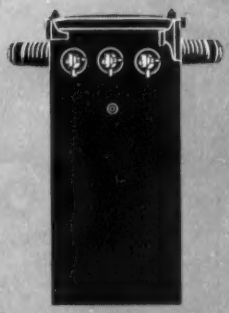
Federal-Pacific electrical equipment for light and power is today's leading specification both for new construction and modernization programs. Most of this equipment is quickly and economically assembled from standard units to meet specific requirements. You can always look to it for lowest installation costs . . . and for engineering that assures top efficiency, easy maintenance, and ready adaptability for future changes or expansion.

When you have an electric distribution problem, Federal-Pacific will be glad to study it. Write Federal Electric Products Company, 50 Paris St., Newark 5, New Jersey.

FEDERAL & PACIFIC

ELECTRIC PRODUCTS COMPANY — ELECTRIC MANUFACTURING CORP.

Federal products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct — **Pacific Electric products:** High voltage circuit breakers and power switches ★ Sales offices in principal cities.



KUHLMAN DISTRIBUTION TRANSFORMERS HELP
MAINTAIN A CONSTANT SUPPLY OF LIGHT AND POWER
THAT MAN MAY GO ABOUT HIS MODERN WAY OF LIFE

KUHLMAN

The product of over 60 years of progressive engineering, Kuhlman Transformers are recognized for outstanding dependability.

KUHLMAN ELECTRIC CO.

BAY CITY, MICHIGAN—CRYSTAL SPRINGS, MISSISSIPPI—EXPORT REPRESENTATIVES: INTERNATIONAL STANDARD ELECTRIC CORP., 15TH FLOOR, 50 CHURCH STREET, NEW YORK 7, N. Y.—CABLE ADDRESS: MICROPHONE, N. Y.

TANNER